NBS

Technical Note No. 94

Boulder Laboratories

BIBLIOGRAPHY ON METEORIC RADIO WAVE PROPAGATION

BY

WILHELM NUPEN

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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NATIONAL BUREAU OF STANDARDS

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May 29, 1961

BIBLIOGRAPHY ON METEORIC RADIO WAVE PROPAGATION

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WILHELM NUPEN

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TABLE OF CONTENTS

BIBLIOGRAPHY ON METEORIC RADIO WAVE PROPAGATION

By: Wilhelm Nupen

This bibliography constitutes the second in a series of four or five being prepared by Meteorological Abstracts for the Boulder Laboratories of the National Bureau of Standards. The general subject area of these compilations is Propagation of Electromagnetic (Radio) Waves in the Atmosphere.

The first, comprising over 1,400 titles, was concerned with normal or abnormal Ionospheric propagation.

The present bibliography consists of 368 abstracts on Meteor Trail Propagation, arranged alphabetically by author and including articles dating from the earliest studies by Nagaoka (B-254) in 1929 on the effect of meteoric ionization on radio communication, to the numerous papers reflecting the recent emphasis on meteor burst communication. No material published after 1960 has been included.

Future bibliographies will cover the subjects of Radio Reflections from Auroras, Radioastronomy and Tropospheric Radio Wave Propagation.

The items in the Ionospheric Propagation Bibliography were numbered A-1 to A-1404; those in this Meteor Propagation Bibliography by analogy from B-1 to B-367, and so on.

Abstracts have been taken, in the main, from the published or unpublished abstracts in the files of Meteorological Abstracts and Bibliography (1950-59) or Meteorological and Geoastrophysical Abstracts (1960). The published item number is indicated wherever pertinent. These numbers give a key to the volume and number of MAB or MGA in which the item first appeared. For example, 10.1-167 indicates an abstract (number 167) in Vol. 10, Number 1 (Jan. 1959 of MAB; 11D-35 would be the 35th item in the special bibliography appearing in Part II of the April 1960 issue of MGA).

A number of the abstracts were taken from an excellent bibliography by L. A. Manning (B-368). These are properly credited to this author. The authors of abstracts, whose initials appear in this bibliography, are listed below. The subject and geographic outlines give a good idea of the scope and detail of subject matter found herein. An author and chronological index appear at the end of the bibliography.

We wish to express appreciation for the assistance rendered by Mrs. Dorothy Gropp in preparing and checking bibliographic entries; and also to Geza Thuronyi for improving the accuracy of the compilating.

Malcolm Rigby
Editor

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Other sources of abstracts

L. A. Manning   Authors abstracts   Physics Abstracts

SUBJECT OUTLINE

I. GENERAL WORKS

II. THEORIES

c. Miscellaneous

Atmospheric pressure. B-86, 87, 115, 164, 166
Atmospheric density. B-30, 31, 86, 155, 170, 260
Atmospheric temperature. B-115, 329
Atmospheric scale height. B-86, 87, 164, 170, 327
Atmospheric absorption. B-181, 311
Atmospheric waves. B-151, 152
Atmospheric noise. B-27, 85
Atmospheric effects on meteors. B-90, 329
Atmospheric cloud discharges. B-156
Scatter cloud production. B-61, 62

d. Molecular and atomic aspects

Molecular diffusion. B-124
Electron attachment. B-48
Artificially produced electron cloud. B-259
Ionized hydrogen. B-126
Protons. B-126

3. Cosmic Factors

Exosphere. B-126
M-region. B-199, 276
Solar influences. B-257, 271
Cosmic noise. B-67, 85, 288

V. METEOR PHENOMENA

1. Showers/streams

Arietids. B-317, 323
Becvar's. B-39
Biela's comet. B-191
Bielid. B-39, 191
Corona Australids. B-317
δ - Aquarid. B-179, 209, 317
η - Aquarid. B-209
Geminid. B-6, 43, 47, 65, 88, 106, 240, 275, 276, 317, 323, 325, 350
Giaconobid. B-4, 139, 140, 187, 329
Giacobini-Zinner. B-216
Leonid. B-12
Lyrid. B-240
Orionid. B-317
Perseid. B-88, 94, 180, 189, 211, 237, 241, 244, 286, 317, 323, 354
Phoenicid. B-322
Quandrantid. B-40, 65, 148, 358

5. <u>Frequencies</u>

1 kc/s - 500 Mc/s. B-132, 133
100 kc/s. B-250
1600 kc/s - 6500 kc/s. B-363

1-10	Mc/s.	B-12, 32, 109, 270
10-20	"	B-29, 73, 127, 216, 288, 303, 304
20-30	"	B-85, 216, 256, 270, 287, 306
30-40	"	B-18, 47, 76, 108, 172, 179, 184, 200, 210, 241, 275
40-50	"	B-1, 36, 184, 238, 250, 271, 302-311, 338
50-60	"	B-13, 19, 21, 27, 40, 67, 287, 338
60-70	"	B-324, 338
70-80	"	B-18, 108, 184, 238
80-90	"	B-1
90-100	"	B-295, 306
100-200	"	B-11, 76, 91, 135
200-300	"	B-233
400-500	"	B-132
600	"	B-295
$>$ 3,000	"	B-295
$>$ 10,000	"	B-295

B. <u>Frequency ranges</u>

HF. B-11, 49, 124, 183, 250
VHF. B-1, 9, 27, 28, 78, 148, 229, 287, 305, 339, 343, 347
UHF. B-100, 281, 338, 346

Frequency variation. B-126
Choice of frequency. B-238
Dependence on frequency on echo duration. B-270

6. <u>Wave lengths</u>

0.3 m.	B-282	6.4	m.	B-178
0.5 "	B-129	8.2	"	B-115, 188, 260
1.4 "	B-188	9.2	"	B-203, 205, 206
2. "	B-9	10	"	B-95, 163
2.8 "	B-203, 205, 206	15	"	B-129
4. "	B-119, 163, 188	17	"	B-119
5.4 "	B-203, 205, 206	21	"	B-35

VII. ECHO CHARACTERISTICS

VIII. METHODS AND TECHNIQUES OF OBSERVATIONS

IX. INSTRUMENTS, EQUIPMENT, ETC.

GEOGRAPHICAL OUTLINE

I. HEMISPHERES AND REGIONS

II. CONTINENTS

CHRONOLOGICAL INDEX

1957
B-9, 14, 17, 18, 22, 24–29, 46, 51, 55, 81–84, 100, 103, 115, 123, 124, 130, 146–148, 155, 175, 197, 198, 227, 237, 245, 249, 250, 259, 262, 266, 271, 274, 287, 297, 307–309, 311, 318–320, 339, 340

1958
B-7, 17, 23, 36, 50, 59, 71, 105, 131, 132, 134, 149, 150, 156, 172, 178, 228–230, 236, 238, 251, 252, 261, 275, 276, 278, 280, 321, 322, 337, 338

1959
B-47, 48, 64, 93, 94–96, 116–118, 122, 125, 151, 152, 173, 177, 213, 231–234, 239, 246, 253, 279, 281, 286, 290, 298, 299, 323–327, 348, 350, 352-354, 360, 361

1960
B-3, 52–54, 85, 97–99, 104, 119, 120, 126, 133, 135, 157, 171, 174, 215, 247, 260, 263, 267, 310, 349, 355–359, 362, 364–366

BIBLIOGRAPHY ON METEORIC RADIO WAVE PROPAGATION

B-1 Allen, E. W., Jr., Reflections of very high-frequency radio waves from meteoric ionization. Institute of Radio Engineers, Proceedings, 36(3):346-352, March 1948. 9 figs., 7 refs., eqs. DLC--Describes recording of bursts of signals due to meteors over oblique paths using f. m. and t. v. signals in the 42 to 84 Mc/s range. Shows signal strength records for paths of 337, 720, and 1370 miles. Path lengths for the meteor propagated signals were found by sweeping an f. m. signal through a narrow receiver pass band. The minimum path lengths corresponded to reflectors at approximately E-layer heights. Plots intensity of echoes versus rate; also plots the diurnal and seasonal variation of burst rate. Found that condition for burst production was that echo came from side of trail, Computes the radius of the equivalent metallic reflector for the largest meteors observed, but makes an arithmetical mistake which results in greatly underestimating their size. For comparison, these largest meteors returned 70 microvolts per meter; 5 microvolt per meter; meteors occurred about 20 times an hour. Shows echoes on 44. 3 Mc/s having exponential form and decay. --L. A. Manning.

B-2 Almond, M.; Davies, J. G. and Lovell, A. C. B., The velocity distribution of sporadic meteors, Pt. 1. Royal Astronomical Society, Monthly Notices, 111(6):585-608, 1951. 8 tables, 12 figs., foot-refs., eqs. Pt. 2, Ibid., 112(1):21-39, 1952. 7 tables, 7 figs., foot-refs., eq. DLC--The radio diffraction technique was used to measure the velocities of sporadic meteors. The velocity distribution measured during three separate experiments, made between 1948 and 1950, are compared with theoretical distributions. There is no evidence for a significant hyperbolic velocity component. There is no change in velocity distribution with meteor magnitude down to the fifth magnitude. Fainter meteors were studied in Pt. 2. The results are similar. A fuller discussion of magnitude range is given and it is concluded that the majority of meteors in these new experiments were probably in the magnitude range 6. 0 to 7. 5. (Met. Abst. 8H-17)--From authors' abstract.

B-3 Appleton, Sir Edward and Naismith, R., Radar detection of meteor trails. Nature, London, 158(4026):936-938, Dec. 28, 1946. 3 figs., ref. DLC--Review of British and American research work on meteoric origin of short period ionospheric radio echoes. --W. N.

B-4 Appleton, Sir Edward and Naismith, R., The radio detection of meteor trails and allied phenomena. Physical Society of London, Proceedings, 59, 3(333):461-473, May 1, 1947. 10 figs., 3 plates, ref. Discussion. Results of radio (echo) soundings on Giacobinid meteor shower of Oct. 10, 1946. Confirm that ionization bursts observable at all hours of day are due to sporadic meteors. E-layer ionization (sporadic) in temperate latitude due to same cause. (Met. Abst. 1-173).

B-5 Appleton, Sir Edward, Finding things out with radio and rockets. Advancement of Science, London, 10:355-364, 1954. GB-MO--Good popular account of exploration of the atmosphere by balloon, radiosonde and rocket (mainly determination of temperature stratification) and of the ionosphere by radio pulses of different frequencies. Author continues with information from solar radiations and meteors, and ends with a discussion of the possibility of space travel. (Met. Abst. 6.9-84)--C.E.P.B.

B-6 Aspinall, A.; Clegg, J. A. and Hawkins, G. S., A radio echo apparatus for the delineation of meteor radiants. Philosophical Magazine, London, 42(328):504-514, May 1951. 9 figs., table, 13 refs. --Description and schematic diagram of the apparatus in use at Jodrell Bank Experimental Station since Sept. 1949. Results from the Geminid showers 1949 and 1950 are discussed; they show the accuracy and resolving power of the apparatus. --W. N.

B-7 Astapovich, Igor Stanislavovich, Metornye iavlenieniia v atmosfere Zemli. (Meteoric phenomena in the earth's atmosphere.) Moscow, Gosudarstvennoe Izdatel'stvo Fiziko-Mathematicheskoi Literatury, 1958. 640 p. 285 figs., 14 tables, 1004 refs., 174 eqs. DWB (523.5 A852me)--A thorough text with ample theory, data, graphs, illustrations, etc., on all phases of meteors and their observation by visual, photographic and radar techniques, starting with 2 chapters giving a historical account of meteor research, followed by 33 chapters covering, among other things, the earth's atmosphere in relation to meteors, meteors as means of sounding the atmosphere, eye observations, visibility, types of meteors, visual observation methods, photographic methods, radio methods, frequency of meteors, radiants, height, speed, orbits, brightness, spectra, temperature, dimensions, form, ablation, theory, mass, ionization, gaseous trails, electromagnetic phenomena, bolides, trajectories of meteorite fall, acoustics of bolides and meteorites, meteoroseismic phenomena, telescopic meteors, cosmic dust of meteoric origin in the atmosphere and meteoric matter at the surface. (Met. Abst. 11.9-5) --M. R.

B-8 Bain, W. C. (D.S.I.R. Radio Res. Sta., Slough), The azimuth distribution of oblique reflections from meteor trails and its relation to meteor radiant distributions. Journal of Atmospheric and Terrestrial Physics, N. Y., 17(3):188-204, Feb. 1960. 10 figs., 5 tables, 14 refs., 7 eqs. DLC--Azimuth distributions of the meteor reflections to be expected at various times of day on a 1740 km north-south transmission path at v.h.f. are calculated from three initial radiant distributions of sporadic meteors. These distributions were: (1) a distribution of meteors, magnitude about 7, obtained by workers at Jodrell Bank; (2) a uniform heliocentric distribution in the plane of the ecliptic; (3) a heliocentric distribution uniform over the celestial sphere. It was found that the third of these gave the best fit to the azimuth results obtained by MEADOWS (1958) on such a path at a frequency of 37 Mc/s; the meteors observed extended downwards in intensity to magnitude 10. Calculations on the forward scattering of radio waves by meteors should therefore be based on this distribution. Observational results are also presented for a very similar path with a frequency of about 70 Mc/s; they resemble those obtained at 37 Mc/s, although not identical to them. The cause of the differences is unknown, but they may be due to the transmitter polar diagram not being identical at the two frequencies. (Met. Abst. 11.10-11)--Author's abstract.

B-9 Bain, Walter F., VHF meteor scatter propagation. QST, West Hartford, Conn., 41(4):20-24, 140, 142, 144, April 1957. 2 figs., 2 tables. DLC--After a general explanation of the topic, hints are given on how to effectively exploit meteor trail ionization, particularly in the 2 m λ range, including antenna orientation, etc. Meteor shower data for VHF use are tabulated. --W. N.

B-10 Banerji, R. B., Meteor trails as reflectors of radio waves: interpretation in terms of high frequency radar. Pennsylvania. State Univ. Ionosphere Research Laboratory, Contract AF 19 (604)-1304, Scientific Report, No. 80, Dec. 15, 1955. 51p. 16 figs., table, 23 refs., eqs. --

The theory of the formation of meteor trails is reviewed qualitatively and certain relevant quantitative features discussed. On this basis the phenomena of reflection and scattering from such trails is considered in detail. The number of meteor echoes that can be expected in a typical radar system is calculated under search and tracking conditions. The preferred direction of observation of meteor showers by a radio equipment is worked out for different showers. Echo duration and range distribution are also determined. (Met. Abst. 8H-50) --Author's abstract.

B-11 Bateman, Ross; McNish, A. G. and Pineo, Victor C., Radar observations during meteor showers Oct. 9, 1946. Science, 104(2706):434-435, Nov. 8, 1946. 2 figs. --A SCR-270 D radar at 107 Mc/s was used in the tests indicating radar's future useful application to investigations of the physical structure of the ionosphere and how meteor reflections affect radio propagation and the usefulness of high frequencies. --W. N.

B-12 Bhar, J. N., Meteors and upper atmospheric ionization. Indian Journal of Physics, Calcutta, 11(2):109-118, 1937. DLC (Q73.C3)--Describes nature of meteors. States air cap can form in front of meteor if air density is $p = 5.6 \times 10^{-9}/rv$ where r is meteor radius in cm, v is velocity in km/s. Measured ion density during Leonid shower. On day of shower maximum measured E-layer critical of about 6 Mc/s; F 1-region also suffered abnormal increase, but not at time of shower. Finds no F 2 evidence. Thinks amount of ionization produced depends on amount present.--L. A. Manning.

B-13 Billam, E. R. and Browne, I. C. (both, Univ. of Manchester, Jodrell Bank Experimental Station), Observations of polarization effects in radio echoes from meteor trails. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 73-77. 5 figs. (incl. photo), 5 refs., eqs.) DWB--An aerial system consisting of two Yagi arrays mounted on a common axis with their planes of polarization mutually perpendicular has been used to observe meteor echoes at 55 Mc/s. A preliminary account is given of the results, which agree well with the theory of KAISER and CLOSS for long-duration echoes. There is good qualitative agreement with the theory for short duration echoes, but the observed resonance is often greater than that predicted. Echoes in the transition between short and long duration often behave anomalously. (Met. Abst. 8H-108)--Authors' abstract.

B-14 Bliss, W. H. and Wagner, R. J., Jr., Experimental facsimile communication utilizing intermittent meteor ionization. Institute of Radio Engineers, Proceedings, 45(12):1734-1735, Dec. 1957. 4 figs. --Encouraging results of facsimile transmission over a 910 mile path are discussed and illustrated. The transmitter, located at NBS, Havana, Illinois, and the receiving equipment are described briefly. --W. N.

B-15 Booker, Henry G. and Cohen, Robert (both, Cornell Univ.), A theory of long-duration meteor-echoes based on atmospheric turbulence with experimental confirmation. Journal of Geophysical Research, Wash., D. C., 61(4):707-733, Dec. 1956. 12 figs., table, 21 refs., 47 eqs. Discussion by L. A. Manning and V. R. Eshleman, Ibid., 62(3):368-371, Sept. 1957. DLC--The radius of meteor trails is computed for small eddies and for large eddies. The radius is about 10 m one second after meteor trail formation and increases to 10^4m after several hundred seconds; at the same, the central electron density decreases with time. The intensity of radio echoes scattered from meteor trails decreases as the cube of the time in the few seconds after larger eddies modify the ionization. After that the echo decay occurs faster because electrons become attached to air molecules. (Met. Abst. 10.8-130)--S. Fritz.

B-16 Booker, H. G. (Cornell Univ.), Turbulence in the ionosphere with applications to meteor trails, radio star scintillation, auroral radar echoes, and other phenomena. Journal of Geophysical Research, Wash., D. C., 61(4):673-705, Dec. 1956. 11 figs., 43 refs., 63 eqs. DLC--Two scales of turbulence are discussed, since large eddies are responsible for forward scattering phenomena and small eddies for back-scatter. Molecular diffusion theory forms the basis for small scale eddy formulas; Richardson's number is used for the large scale eddies. Large eddies have time constants of 40 to 100 seconds; small eddies about 0.4 sec near 100 km. Large eddies have a scale of 1.6 km, small eddies about 1.3 meters. The coefficient of eddy diffusion in meteor trails is less than 10 for small eddies and increases to 10^4 for large eddies. The large eddies responsible for radio star scintillation are located near 200 km. The turbulence power in watt/kg is given as 5×10^4 in the troposphere, 25 at the meteoric level and 1000 at the scintillation level. (Met. Abst. 10.8-131)--S. Fritz.

B-17 Booker, Henry G. (School of Elec. Engr., Cornell Univ., Ithaca, N. Y.), Concerning ionospheric turbulence at the meteoric level. Journal of Geophysical Research, Wash., D.C., 63(1): 97-107, March 1958. 3 figs., 13 refs. DLC--

BOOKER (Ibid., 1956) and BOOKER and COHEN (1956) have given reasons for thinking that application of fluid mechanics to meteoric phenomena leads to results in discord with previous thought. This has led to a discussion (MANNING and ESHLEMAN, 1956) that is continued in this paper. An underlying feature of the discussion is a phenomenon that may be described as the rough trail paradox. This arises from the fact that the turbulence velocity of the large eddies is about ten times greater than the turbulence velocity of the small eddies. For a trail that has been rendered rough by the small eddies, let us examine the echoes from two points, separated by a distance of the order of the large eddy size. Due to the motion of the large eddies, interference between these two points is taking place at a rate ten times faster than the rate at which the phase of the echo from either point is taking up random values due to the motion of the small eddies. The upshot is that, as already mentioned by BOOKER, the most obvious features of the fading of long-duration meteor echoes are controlled by the motion of the large eddies even when the mechanism of return is backscattering associated with the small eddies. Failure to appreciate this point seems to have led MANNING and ESHLEMAN to claim as an antithesis to the KOLMOGOROFF-HEISENBERG theory of turbulence results that, in fact, are consistent with it. (Met. Abst. 9.11-217)--Author's abstract.

B-18 Bowden, K. R. R. and Davies, J. G., The time distribution of meteors. Journal of Atmospheric and Terrestrial Physics, London, 11(1):62-66, 1957. 3 figs., table, 7 refs., 6 eqs. DWB--Four records of pulsed radio echoes (over 3000) on 72 and 36 Mc/s at Jodrell Bank were analyzed by 4 methods. The meteor echo rate has a diurnal and annual variation. The number of echoes in half-minute periods, and intervals between successive echoes, show no significant departure from a random distribution. No evidence was found that meteors enter the atmosphere in groups. (Met. Abst. 9.1-280)--C.E.P.B.

B-19 Briggs, B. H., Observations of short bursts of signal from a distant 50 Mc/s transmitter. Journal of Atmospheric and Terrestrial Physics, London, 8(3):171-183, March 1956. 8 figs., table, 12 refs., 9 eqs. DWB--Signal bursts from Kirk o'Shotts television station were recorded at Cambridge, 480 km away. The histogram of time intervals between bursts is fitted by the expected curve if they occurred at random, but there is some evidence that a few occur in trains of three. Two types of wave were found, one with rapid exponential decay, the other maintained for 2-3 sec, usually with fluctuations of amplitude. It is concluded that most, if not all the bursts are reflections from meteor trails and that most of them come from near the receiver. (Met. Abst. 7.8-251)--C. E. P. B.

B-20 Browne, Ian C. and Kaiser, T. R. (both, Jodrell Bank Exp. Station, Manchester Univ.), The radio echo from the head of meteor trails. Journal of Atmospheric and Terrestrial Physics, London, 4(1/2):1-4, 1953. 2 figs., table, 7 refs., eqs. DWB --A theoretical account in terms of familiar diffraction theory is offered in explanation of a type of radio echo, apparently originating at the moving head of a meteor trail, which is sometimes observed in addition to the well-known specularly reflected echo. No assumptions are invoked beyond those commonly accepted as necessary to explain the specularly reflected echo. The theory predicts intensities of head echoes in agreement with observation, and also predicts that the intensity of the head echo relative to that of the specularly reflected echo should be proportional to the radio wavelength and inversely proportional to the difference in range between the two echoes. It is suggested that other anomalous meteor echoes may arise from discontinuities associated with visual flares. (Met. Abst. 8H-26)--Authors' abstract.

B-21 Browne, Ian C.; Bullough, K.; Evans, S. and Kaiser, T. R., Characteristics of radio echoes from meteor trails, Pt. 2, The distribution of meteor magnitudes and masses. Physical Society of London, Proceedings, Ser. B, 69(1):83-97, Jan. 1, 1956. 12 figs., 2 tables, 19 refs., 12 eqs. Also: Billam, E. R. and Browne, I. C., Pt. 4, Polarization effects. Ibid., 98-113. 13 figs., 11 refs., 5 eqs. DWB--Pt. 1 by A. C. B. Lovell and J. Clegg (see ref. No. 188). Pt. 3 by Greenhow in 1952 (see ref. No. 110). Pt. 2 deduces the distribution of meteor magnitudes and masses from radio echo data. The ranges of magnitude which contribute most to the mass are computed for various showers. In Pt. 4 observations of polarization on 55 Mc/s are described and amplitude A of persistent echoes is related to duration I by $A \propto T^{0.3}$. (Met. Abst. 8H-78)--C. E. P. B.

B-22 Brysk, H. (Radiation Lab., Michigan Univ.), Electromagnetic scattering by low density meteor trails. Journal of Geophysical Research, Wash., D. C., 63(4, Pt. 1):693-716, Dec. 1958. 3 figs., 2 tables, 16 refs., 105 eqs. DWB, DLC--Expressions for the scattering of electromagnetic radiation by a meteor trail have been derived for a simple model. A uniform line density of electrons is first considered, of sufficiently low density that the interaction between electrons can be neglected. Then, the model is extended to include the effect of ambipolar diffusion. Finally, the fast initial penetration of the particles before they are slowed down to thermal velocities is taken into account. Similar model assumptions have previously appeared in the literature, except that an effort has been made here to retain consistently the intrinsic three-dimensional geometry of the problem. The derivations are based on an idealized superposition of antenna patterns with a constant gain within the coverage and a sharp cut-off; the extension to an arbitrary pattern is simple, and the procedure is sketched. Various limiting cases are considered, with careful specification of the realm of validity of approximations. The familiar expressions emerge in the large wave length limit for specular scattering. Nonspecular scattering and intermediate orientations are also treated. A small wave length limit is derived, and the transition wave lengths are explored in detail. (Met. Abst. 11. 1-304)--Author's abstract.

B-23 Brysk, H., Electromagnetic scattering by high-density trails. Institute of Radio Engineers, Transactions, (Special Supplement) AP-7:330-336, Dec. 1959. 5 figs., 5 refs., 66 eqs.--Not only the electron line density, but the wavelength of observation, and the altitude of the trail establish limits on the validity of the low density approximation. The results of a new model for scattering by supercritical density distribution, the process being a superposition of Compton effects and the electron attenuated by refraction are compared with results of the usual approach. Non-Gaussian distribution calculations clarify physical interpretation.--Based on author's abstract.

B-24 Campbell, L. L., Storage capacity in burst-type communication systems. Institute of Radio Engineers, Proceedings, 45 (12):1661-1666, Dec. 1957. 2 figs., 2 refs., 42 eqs. DLC--The relationship between storage capacity and mean rate of transfer of information is derived for a JANET-type system. Specific probability distributions are then assumed for the durations of signals and the intervals between signals. An explicit formula for the mean rate as a function of storage capacity is calculated for the probability distributions. The specific distributions chosen are thought to approximate those which will be found in a typical JANET system. --Author's abstract.

B-25 Campbell, L. L. and Hines, C. O., Bandwidth considerations in a JANET system. Institute of Radio Engineers, Proceedings, 45(12):1658-1660, Dec. 1957. 5 refs., 13 eqs. DLC--Using the mean rate of transfer of information as the criterion for comparison of systems discussed advantages of a new system are calculated. --W. N.

B-26 Carpenter, Robert J. and Ochs, Gerard R., Experimental equipment for communication utilizing meteor bursts. Institute of Radio Engineers, N. Y., IRE Convention Record, Pt. 1:283-293, Aug. 20-23, 1957. 9 figs. DLC--Results of field tests over the 390 mile path between Sterling, Va. and Walpole, Mass., with the equipment described, are discussed. An error rate of 3% was found. --W. N.

B-27 Carpenter, R. J. and Ochs, G. R., The NBS meteor-burst communication system. Institute of Radio Engineers, Transactions, CS-7(4):263-271, Dec. 1959. 11 figs., tables, 7 refs., 3 eqs. DLC--This project was undertaken in 1955 to investigate the properties of the intermittent reception of VHF signals over long distances by meteoric propagation and their communication usefulness. To accomplish this, a complete duplex teletype system, operating at about 50 Mc, was constructed, and their results are reported from tests made over a 1227 km east-west path. Comparisons are made of burst transmissions of 10, 20, 40, and 80 times normal teletype speed and of variations in a number of control system parameters. For the system under test, the optimum speedup was 40 X, which produced a daily average channel capacity of about 40 wpm with a character error rate of about 0.0035 (with the best control system settings). Higher speedup ratios are advocated for future systems. The most serious causes of outages in this type of system are atmospheric noise and sustained multipath distortion from competing modes such as Es and auroral propagation. (Met. Abst. 11.9-101)--Authors' abstract.

B-28 Casey, J. P. and Holladay, J. A., Some airborne measurements of VHF reflections from meteor trails. Institute of Radio Engineers, Proceedings, 45(12):1735-1736, Dec. 1957. fig., 3 refs. DLC--More bursts were detected with the air-borne than with ground equipment during the experimental transmission from Cedar Rapids, Iowa to So. Dartmouth, Mass. In any given area there are thus two ratios, one in the air, and one at the ground. The correlation is shown in curves. --W. N.

B-29 Castillo, H. T., Characteristics of meteor bursts on 15 mc over a 608 km path. Aeronautical Electronics Digest (4): 129-138, 1955. 7 figs. DLC--A paper presented at the National Conference on Aeronautical Electronics, May 9-11, 1955. The description includes meteor characteristics and instrumentation used. It is concluded that oblique reflection from meteor trails is usable for long distance communication in the 15 Mc region when otherwise blocked. Also, meteors can be checked under any weather condition with simple equipment and permit determination of upper atmospheric winds from meteor reflected radio echoes. --W. N.

B-30 Ceplecha, Zd., Meteor photographs, Pt. 1, Air densities. Bulletin of the Astronomical Institutes of Czechoslovakia, Prague, 4(3):55-60, 1953. 4 figs., 3 tables, 4 refs., 2 eqs. Russian summary p. 59-60. Pt. 2, The photographed breakage of Meteor 131a. Ibid., 4(5):113-119, 1953. 4 figs., 2 tables, 4 refs., 6 eqs. Russian summary p. 118-119. Also: Link, F., Sondages météoriques de la haute atmosphere. (Meteoric soundings of the upper atmosphère.) Ibid., 4(6):168-170, 1953. 2 figs., 3 refs., 7 eqs. Russian summary p. 170. DLC. Also: Link, F., Scale height in the ionosphere deduced from meteors. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 78. 2 refs.) DWB--Paper 1: From 14 double photographs taken in 1951, velocities, decelerations, sizes and heights of meteors are determined. From these data the author calculates (according to a mathematical method of analysis developed in this paper) atmospheric densities between 60 and 100 km. Results of the calculation are tabulated and graphically presented. Pt. 2 of the paper contains calculations in connection with various factors involved in the breakage of a meteor, such as geometrical conditions, luminous phenomena, pressure on the front part, etc. An increase of atmospheric density at the height of breakage (around 60 km) is suggested as one possible explanation of the phenomenon. LINK reconsiders the photographic material used by CEPLECHA and derives his own atmospheric density model in agreement with results obtained at Harvard. He also finds that between 80 and 100 km temperature appears to be decreasing with lower latitude. The note in METEORS is a discussion of the results of CEPLECHA and LINK. (Met. Abst. 8H-27)--G.T.

B-31 Ceplecha, Zd. (Astronomical Inst. of the Czechoslovak Academy of Sciences), Atmospheric corrections to meteor velocities and the atmospheric density gradient. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 81-85. tables, 3 refs., 8 eqs.) DWB--The original velocity v_∞ of a meteor may be calculated by two methods: 1) by extrapolation of the observed velocity height dependence and 2) by the physical theory of meteors (this has been used exclusively up to the present time). A method of calculating the original velocity v_∞ and the density gradient, b, for long bright meteors is derived in the paper from the knowledge of the mean observed velocities and heights at three different points on the meteor trajectory. The Whipple formulas for the calculation of v_∞ are given. A new method of calculating the original velocity v_∞ of a meteor is derived. This can be used for photographic meteors with smooth light curves. The velocity v_m at maximum light of the meteor and the constant K_m in the mass equation of the Hoppe theory are the only values necessary for the calculation of the original velocity v_∞ and these may be derived directly from the measured values. It is not necessary to know the atmosphere density gradient, b, for the calculation of v_∞. The gradient b may be calculated from the Whipple formulas by means of directly measured values. (Met. Abst. 8.1-175) --Author's abstract.

B-32 Chamanlal, C. and Venkatamaran, K., Whistling meteors: Doppler effect produced by meteors entering the ionosphere. Electrotechnics, 14:28-40, 1941. --Describe whistles and compute Doppler velocity. Point out down whistles on hi-frequency side, up on lo-side of carrier. Show meteor velocities 4-5 times higher at 6 A.M. than 6 P.M. Say weak signal needed so avc voltage not great. Consider only ground wave signals practical to produce beat. Measured whistle signal as 1/2 microvolt or so. State number heard greater than 100 times number seen. Describe up and down whistles, state down more common. Claim sometimes whistle has pronounced harmonics. Using 7 and 15 Mc/s simultaneously, more whistles are heard on 7 Mc/s and the whistle comes in on 15 Mc/s slightly later than on 7 Mc/s. Watching a pulse transmitter, echoes are usually seen following a whistle on 7 Mc/s. The virtual distance is often well above the normal E-region height. Have rarely seen a moving echo coincident with a whistle. --L. A. Manning.

B-33 Chapman, Sidney (Queen's Col., Oxford), Meteors and meteorites. Washington Academy of Sciences, Wash., D. C., Journal, 42(9):273-282, Sept. 1952. refs. DWB--In a smoothly-worded, non-technical lecture the author gives a general insight into the physics of interstellar matter entering the earth's atmosphere, discussing subjects like number, height and speed or meteors; their observation by visual methods and radar; meteor showers and supershowers, meteor spectra, meteoric ionization of the atmosphere; investigation of the upper atmosphere by means of meteor observation, meteorite falls; the composition, structure and radioactivity of meteorites and light and sound phenomena connected with their passage through the atmosphere; historical meteorite falls, etc. (Met. Abst. 4.5-246)--G.T.

B-34 Chechik, P. O., Radiotekhnika i elektronika v astronomii. (Radiotechnique and electronics in astronomy.) Moscow, Gosenergoizdat, 1953. 103 p. 76 figs., 22 tables, foot-refs., bibliog. (38 refs.) p. 102-103. Massovaia Radiobiblioteka, No. 189. DLC (QB475.C45)--This small technical text contains chapters on various aspects of time (or longitude) on earth and its radio dissemination or determination; on meteors and their study by radio; on lunar, solar and galactic investigations by radio, on the significance and application of photo-elements in astronomy and their measurement. The effect of the ionosphere, ionospheric winds, solar influences in magnetic field of earth and radio frequency radiation from sun and space are all treated. All references are to Soviet literature. (Met. Abst. 8H-28)--M. R.

B-35 Chechik, P. O., Dal'niaia radiosviaz' vsledstvie otrazhenii ot meteornykh sledov. (Distant radio communication due to reflection from meteoric tracks.) Priroda, Moscow, 43(12): 92-93, Dec. 1954. DLC--Considerations are presented indicating that as a result of the vaporization of meteors in the earth's atmosphere, ions are formed which recombine and diffuse. The amplitude of the radio signal reflected from meteoric tracks is proportional to the electron density and owing to recombination and diffusion it diminishes gradually. Examples are cited of the possibility of radio communication at night with waves of 21 m at distances of 1200 km and at a time when there was no reflection from the regular ionospheric layer. (Met. Abst. 6.10-294)--I. L. D.

B-36 Chubb, H. E., Development of meteor burst communication systems for the Navy. San Diego, Calif., U. S. Navy Electronics Lab., 1958. (4 p.) 10 figs. (incl. photos), 7 refs. Reprinted from National Convention on Military Electronics, 2nd, 1958, Conference Proceedings, p. 266-269. DWB (reprint file)--Transmissions at 43.5 Mc from Palo Alto, Calif. were monitored at NEL, San Diego, a distance of 690 km, and aboard a Navy vessel off-shore in the San Diego area. The received meteor burst signals were analyzed to determine the expected duty cycle and design requirements of a meteor burst link between these two locations. A simple closed loop system was developed and tested at NEL with the Palo Alto station being used as a repeater. Teletype information transmitted in high speed bursts was received, processed, and the causes of errors were analyzed. A more sophisticated system was developed to provide duplex operation. One end of the link was installed in a mobile van and is being tested at distances of approximately 400, 700 and 1100 miles. Signals received at San Diego from these test locations will be correlated with those received from the fixed station at Stanford. (Met. Abst. 10.9-308)--Author's abstract.

B-37 Clegg, J. A., Determination of meteor radiants by observation of radio echoes from meteor trails. Philosophical Magazine, 39:577-594, Aug. 1948. DLC--The variation with time of the rate of occurrence and the ranges of the radio echoes from meteor trails as the radiant moves across the heavens is explained and the ranges are estimated for any position of the radiant. Theoretical estimates agree well with experiment.

With a horizontally narrow beam directed at sufficiently low elevation the ranges attain a sharp maximum when the azimuth of the radiant differs from that of the beam by 90°. This is the basis of a method of radiant determination which may be used for finding unknown radiant positions. The accuracy depends on the echo rate, the declination of the radiant and the width and elevation of the aerial beam. Probable errors are $\pm 2^{\circ}$ in r. a. and $\pm 3^{\circ}$ in dec. (Met. Abst. 8H-8)--Physics Abstracts.

B-38 Clegg, J. A., Determination of meteor radiants for the daytime showers of May 1948. British Astronomical Association, Journal, 58(7):271-279, Oct. 1948. 7 figs., table, 8 refs.--The method described depends on broadside radio echo reflection from the meteor produced columns. The results agree well with those of the previous year.--W. N.

B-39 Clegg, J. A.; Lovell, A. C. B. and Prentice, J. P. M., Radio echo and visual observation of the Bielid meteor streams in 1948. British Astronomical Association, Journal, 60:25-27, 1949. 3 tables, 4 refs. Also their: The 1948 return of Becvar's meteor stream. Ibid., p. 27-31. table, 9 refs. DLC (QB1. B-75)--Intermittent radio echo observations were taken in Nov.-Dec. 1948 in an attempt to determine the velocity of the Bielid meteor stream. The only velocity determination obtained showed V = 19.6 20 km/sec against the theoretical 22 km/sec. Determination of radiants by present techniques is insufficient. In the second paper an account is given of radio and visual observations including a tabulated comparison with results of other workers for the years 1946 - 1948.--W. N.

B-40 Clegg, J. A. and Davidson, I. A., A radio echo method for the measurement of the heights of the reflecting points of meteor trails. Philosophical Magazine, London, 41:77-85, Jan. 1950. 4 figs., table, 11 refs., eqs.--Height of meteor trails from radio echoes obtained by 60 Mc/s broadside reflection involved a height finding system described in some detail. Results obtained during the Quandrantid 1949 shower agreed with visual observational results.--W. N.

B-41 Clegg, J. A. and Closs, R. L., Plasma oscillations in meteor trails. Physical Society of London, Proceedings, Sec. B, 64:718-719, Aug. 1951. Unchecked.

B-42 Closs, R. L., Clegg, J. A. and Kaiser, T. R. (Jodrell Bank Experiment Station, Univ. of Manchester), An experimental study of radio reflections from meteor trails. Philosophical Magazine, London, Ser. 7, 44(350):313-324, March 1953. 11 figs., 12 refs. DWB--Theoretical predictions of meteor echoes were tested by measurements with transverse and parallel polarization of the echo amplitudes from single meteor trails mainly in Arietid radiant and the theory was confirmed. (Met. Abst. 4.10-252)--C.E.P.B.

B-43 Davies, J. G. and Ellyett, C. D., The diffraction of radio waves from meteor trails and the measurement of meteor velocities. Philosophical Magazine, 40:614-626, June 1949. DLC--Automatic equipment, using pulse technique, is described for photographic recording of the reflected amplitude of the radio waves in time intervals of the order of milliseconds. The theory of the diffraction effect is considered. Fluctuations in reflected amplitude should occur as a meteor crosses the region of the perpendicular from the observing station. Experiments indicate that the initial amplitude fluctuations are associated with many meteor echoes and possess the correct ratios of zone durations predicted by the diffraction theory. The times taken to traverse specified zones are measured so a method is available for measuring directly the velocity of individual meteors. The velocities of meteors in the Geminid shower of 1947, Dec. 11-14, were measured, and the results agree with photographic and visual measurements. (Met. Abst. 8H-11)--Physics Abstracts.

B-44 Davies, J. G. (Univ. of Manchester, Jodrell Bank Experimental Station), Radio measurements of individual meteor orbits. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 157-158. fig., 3 refs.) DWB--Radio echo measurements of meteor orbits made since 1946 by the range-time technique, and by the diffraction method, using both continuous and pulsed transmission, are described. A single meteor trail was observed from 3 stations 4 km apart by the Davies and Ellyett (1949) method as illustrated. By studying the diffraction patterns, the rate and direction of movement can be determined, and hence the radiants. The method was first used in the 1953 Geminid Showers and for every major shower since, with accuracy of 3% in speed and 2° in radiant for 200-300 orbits per day, or accuracy up to 10% for 2 or 3 times as many. Irregular winds in upper atmosphere are main source of error. (Met. Abst. 7.9-248)--M.R.

B-45 Davies, J. G. and Lovell, A. C. B. (both, Jodrell Bank Experimental Station), Radio echo studies of meteors. (In: Beer, Arthur (ed.), Vistas in astronomy. London. Pergamon Press, 1955. Vol. 1:585-598. 12 figs., 51 refs., 5 eqs.) DLC (QB3.B35)--A description is given of the radio echo techniques for the study of meteors. Particular attention is given to those which are relevant to the work on the astronomy of meteors, such as methods for the determination of meteor radiants and velocities. The discovery and elucidation of the complex series of daytime meteor streams is described as an illustration of the ability of these methods to work under conditions when photographic and visual observations are impossible. A short account is also given of the work on the interstellar meteor problem which has resolved the uncertainty as to whether the sporadic meteors are members of the solar system or come from interstellar space. Brief reference is made to the use of the radio techniques in meteor physics. --Authors' abstract.

B-46 Davis, G. W. L.; Gladys, S. J.; Lang, G. R.; Luke, L. M. and Taylor, M. K., The Canadian JANET System. Institute of Radio Engineers, Proceedings, 45(12):1666-1678, Dec. 1957. 13 figs. (incl. photos). DLC--JANET is a point-to-point communication system based on the forward scattering of radio waves from meteor trails. The properties of the transmission medium are such that special methods are required to take full advantage of them. Factors influencing system design have been discussed elsewhere; it is the purpose of this paper to describe a data handling equipment which has been designed for use on a single channel radio teletype link operating on the JANET principle. The equipment is designed for use with double sideband AM radio links having 3-kc bandwidths. Standard 60 wpm teletype machines are used for input and output, and the instantaneous transmission rate is 1300 wpm. (Met. Abst. 10.4-301)--Authors' abstract.

B-47 Davis, J.; Greenhow, J. S. and Hall, J. E., Combined photographic and radio echo observations of meteors. Royal Society of London, Proceedings, Ser. A, 253(1272):121-129, Nov. 17, 1959. --An experiment designed for simultaneous photographic and radio echo observations of meteors is described. The observations were made by means of a meniscus Schmidt camera and two pulsed radio transmitters operating at frequencies near 36 Mc/s. An analysis is given of the radio echo and photographic measurements of a bright Geminid meteor. The radio echo duration is found to be several orders of magnitude less than would be expected on simple diffusion theory. This behaviour is explained in terms of the attachment of electrons to neutral oxygen molecules to form negative ions, and a value for the attachment coefficient is determined. --Physics abstracts.

B-48 Davis, J.; Greenhow, J. S. and Hall, J. E., The effect of attachment on radio echo observations of meteors. Royal Society of London, Proceedings, Ser. A, 253(1272):130-139, Nov. 17, 1959. --The effects of the electron attachment to neutral air molecules on the characteristics of radio echoes from meteor trails are studied. Previously it has been assumed that diffusion processes were primarily responsible for the reduction of volume electron density in a meteor trail, and also in limiting the echo duration. A value of the attachment coefficient $B_e = 5 \times 10^{-15}$ cm^3 sec^{-1} was determined from combined photographic and radio echo observations of a meteor. An effect of an attachment coefficient of this magnitude is to reduce the expected echo duration by a factor of 1000 or more for a bright fireball. The observed relation between visual meteor magnitude and echo duration is explained by this mechanism, as are the departures from the wavelength squared variation of echo duration predicted by diffusion theory. Attachment processes also account for the observation that the final heights of enduring meteor echoes all center about 95 km, even though bright meteors may show a maximum in light intensity below 80 km. --Physics Abstracts.

B-49 de Bettencourt, J. T. and Whitcraft, W. A., Jr., Long range meteoric echoes via F-layer reflections. Institute of Radio Engineers, Transactions, AP-4:72-76, Jan. 1956. 11 figs., table, 11 refs. DLC--HF observations of meteoric backscatter with CoZ1 equipment (12 and 16 Mc) at So. Dartmouth, Mass. in 1949 and again in 1954, are discussed. Echo ranges of more than 1000 miles may well be due to backscatter from the trail, bouncing to and from the ionosphere via the F-region. --W. N.

B-50 de Bettencourt, J. T.; Ward, A. E. and Goldberg, B., Meteor burst propagation. Institute of Radio Engineers, Convention Record :127-132, March 1958. Unchecked.

B-51 Deeds, W. E., Research in meteor-scatter communication. Tennessee. University, Technical Report, No. 1, Sept. 1957. 13 p. AD 144-562. Unchecked.

B-52 Dokuchaev, V. P., Elektricheskii razriad pri prolete meteorov v atmosfere Zemli. (Electrical discharge during the flight of meteors in the earth's atmosphere.) Akademiia Nauk SSSR, Doklady, 131(1):78-81, 1960. 14 refs., 6 eqs. DLC--The observed electromagnetic phenomena accompanying the flight of meteors in the earth's atmosphere, such as long and medium radio wave emission from ionized meteor trails, the luminescent aureola around flying particles, etc. can be explained by an electric discharge in the gas arising during the flight of meteors in the upper atmosphere. For the existence of the charge there is necessary a mechanism explaining the origin of sufficiently strong electric fields with a potential E exceeding the penetrating value E_{pen}. The gas discharge in the ionosphere applied to the aurora is considered as arising in induced electric fields and it is shown that electrical induction fields in the meteor region have a potential of $E_o = 10^5$ v/cm. The passage of a meteor in the upper atmosphere is accompanied by the formation of an entirely ionized trail of electrons and ions of meteoric matter so that the meteoric particles form a cloud of well conducting gas surrounded by gas with considerably less conductivity. In order to compute the effect of intensification of the electric field near the end of a meteoric trail the latter is approximated by a very extended ellipsoid of rotation. The intensification of the electrical field near the apex is given by

$$E_{mo} = \left(\frac{l}{r_t}\right) \frac{E_o}{lg\,(2l/r_t)^{-1}}$$

where $r_t^2 = 4\,Dt + r_o^2$ - effective radius of the trail (small semi-axis of the ellipse), D - diffusion coefficient and r_o - initial radius of the trail. The intensification of the field E_o is most intense in the anterior part of the trail. The penetrating value of the potential of the electrical field leading to the formation of an electric gas discharge can be found by means of

$$E = \frac{Ap}{B + lg\,(pd)}$$ where p - gas pressure in mm Hg;

d - length of discharge interval in cm; A and B constants associated with the coefficients of ionization into electrons and ions. Perpendicularly to the magnetic field of the earth the potential of penetration increases, namely: $E'' = \frac{\sigma_o}{\sigma_\perp} E'$

where σ_o and $\sigma_\perp$ = electrical conductivity along and across the geomagnetic field. The intensification of the electric field near the flying meteor is shown to lead to the formation of one form of gas discharge. It is concluded that the luminous aureola adjacent to the moving meteor is a product of the corona of the anterior part of the ionized trail. During the spark discharge the electric current along the trail increases so that the earth's magnetic field may be caused to pulsate. An equation for computing the entire current I_o through the cross section of the trail is developed, namely:

$$I = \int_0^{\infty} \int_0^{2\pi} r j_o \, (r, t) \, dr \, d\phi = \frac{o \, Q E_o}{1 + k Q t}$$

where Q - linear density of electrons; k - coefficient of recombination; $j_o = \Sigma E_o$, where conductivity $\Sigma = \sigma N(r, t)$. -- I.L.D.

B-53 Dokuchaev, V. P., (Radio Physics Scientific Research Inst. at Gorkii Univ.), Formation of an ionized meteor trail. Soviet Astronomy AJ, New York, 4(1):106-109, July/Aug. 1960. 9 refs., 13 eqs. DLC. Transl. of original Russian in Astronomicheskii Zhurnal, Moscow, 37(1):111-114, Jan./Feb. 1960. DLC--The distribution of ionized gas in the wake of a meteor trail through the upper layers of the atmosphere is discussed. A solution is found for the diffusion equation in the presence of an ion source traveling at constant velocity at a small angle to the horizon. It is shown that the plasma concentration in the vicinity of the moving meteor is appreciably greater than in the remainder of the meteor wake. The conditions under which the trail may be approximated to a cylinder with a Gaussian distribution for the plasma concentration as radius are found. (Met. Abst. 11.12-159)--Author's abstract.

B-54 Drouilhet, P. R., Jr. and Otten, K. W., A simple air/ground meteor burst communication system. (In: Desirant, M. and Michiels, J. L. (ed.), Electromagnetic wave propagation, New York, Academic Press, 1960.) Unchecked.

B-55 Dubin, Maurice and Campen, C. F., Jr., Meteors. (In: Handbook of geophysics for Air Force designers, ed. by C.F. Campen, Jr., et al. 1st ed. Wash., D. C., 1957. Ch. 11 (10 p.) 9 figs., 3 tables, 11 refs., eqs.) DWB--Concentrated data in tabular and graphic form on meteor composition, speeds, size, number, showers, dynamics, interaction with atmosphere, penetration of surfaces and radio reflection or scattering from meteor trails, presented in outline form. --M. R.

B-56 Dubin, Maurice (G.R.D., Cambridge, Mass.), Meteor impacts by acoustical techniques. (In: Boyd, R. L. F.; Seaton, M. J. and Massey, H. S. W. (eds.), Rocket exploration of the upper atmosphere. London, Pergamon Press, 1954. p. 26-27. fig.) DWB--Two methods have been used to detect meteorites encountered by rockets in the upper atmosphere: 1) by examination of pits on a polished metal plate, and 2) by counting pips or pulses of short duration on a microphone record (a method devised by J. L. BOHN of Temple Univ.). On the V-2 Blossom IV D flight, 66 pips were detected between 90 and 150 km (70 to 214 sec), and on IV G, 14 pips between 90 and

150 km. The rates were 1 in 2.2 sec and 1 in 6 sec respectively, agreeing with WHIPPLE's 1946 estimate of 0.9 meteorite collision per sq ft per sec. (Met. Abst 8H-40)--M. R.

B-57 Dubin, Maurice (GRD, AFCRC, Bedford, Mass.), Meteor ionization in the E-region. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 111-118. table, 13 refs., eq.) DWB--The theories of meteoric interaction with the atmosphere have been reviewed to determine the total contribution by meteors to the ionization content of the E region. From HERLOFSON's theoretical treatment of this interaction, and WATSON's distribution of the size and numbers of meteoric particles entering the atmosphere per day, the number of electrons produced at various altitudes in the E region was computed. These computations indicated that most of the ionization at higher altitudes resulted from meteors of large visual magnitude. Since, as WHIPPLE has shown, the ablation process would probably not occur in the case of micrometeorites because of heat loss by radiation, the collision processes for ionization were reviewed; it seems that the ionization process is mainly a function of the relative energy of the collision, and therefore, ablation prior to ionization would not be required for small particles. Using the value (of Greenhow and Hawkins, 1952) for the efficiency of the ionization process and the recently revised value for the amount of meteoric material entering the atmosphere per day, the rate of production of electrons was found to be 20 electrons/cc sec. From this value and the recombination coefficients in the E region, the equilibrium electron density in the E region was found to be between 2×10^4 and 7×10^4 electrons/cc. It is therefore proposed that the night-time value for the electron density in the E region results from meteoric bombardment, and that sporadic E is caused by the same process on the assumption that the distribution of meteoric particles in space is nonisotropic and contains centers of high density. Perhaps, also, the interaction of charged micrometeorites with the earth's magnetic field, may be considered as a mechanism for the production of magnetic storms. (Met. Abst. 8.1-180)--Author's abstract.

B-58 Dubin, Maurice (Ionospheric Physics Lab., GRD, AF Cambridge Res. Center), Meteoric bombardment. (In: Van Allen, James A. (ed.), Scientific uses of earth satellites. Ann Arbor, Univ. of Michigan Press, 1956. p. 292-300. 3 figs., table, 12 refs.) DWB, DLC --An experiment for the detection of meteoric particles entering the earth's atmosphere is proposed for a projected earth satellite. A brief review of the research on meteors is made to point out the advantage of measurements made from a satellite. Such measurements would be of scientific importance in determining the role of interplanetary particles as related to the geophysics of the atmosphere, the structure of the ionosphere, sporadic E, noctilucent clouds, airglow, etc. Meteoric particles colliding with the satellite may also constitute a hazard affecting the reliability of other scientific experiments. A method for measuring the influx of meteoric particles into the earth's atmosphere, based on the detection of the acoustical energy generated upon impacts, is described. This technique is reviewed with respect to feasibility, reliability, and sensitivity. Results from V-2 and Aerobee rocket firings using this approach are also presented. The acoustical method for the detection of meteoric particles seems promising as a means of expanding our knowledge of the mass and density of interplanetary matter, and is therefore recommended as a satellite experiment. (Met. Abst. 8H-79)--Author's abstract.

B-59 Budnik, B. S.; Kascheev, B. L.; Lagutin, M. F. and Lysenko, I. A., System for protection from pulse interference in apparatus for recording meteor activity. Radio Engineering and Electronics, 3(11):79-85, 1958. --Block diagrams and description of the system in use since 1957 at the Khar'kov Polytechnic Institute are given. Effectivity of the system to record successfully all reflections from meteor trails is claimed. --W. N.

B-60 Eastwood, E. and Mercer, K. A., A study of transient radar echoes from the ionosphere. Physical Society of London, Proceedings 61, Pt. 2(344):122-134, Aug. 1, 1948. 7 figs., table, 13 refs., 12 eqs. DLC--Results of measurements Jan. 1945 - July 1946 indicating meteoric burst formation within a thin layer at 86 km altitude. It was found that for a radio wave of frequency v, the rate of incidence of bursts between A and A + d A m^2 may be expressed by $C\,dA/v^3A^{3/2}$, C being constant. --W. N.

B-61 Eckersley, T. L., Evaporation of meteors. Nature, London, 160(4055):91, July 19, 1947. ref. --Brief comments on some published photographs of apparent meteors which are explained as smaller meteors evaporating and producing scatter clouds. --W. N.

B-62 Eckersley, T. L., Observations of scatter clouds. Nature, London, 162(4105):24-25, July 3, 1948. 2 figs., 3 refs., eq. --Mechanism of scatter cloud production, other than meteoric, is due to solar ultraviolet radiation during and after Dellinger fades, causing photo-ionization of cosmic dust at 100 km. These particles, before a Dellinger fade producing electron showers, form localized scatter clouds. Meteor produced clouds are disclosed by shorter radio waves than the former. --W. N.

B-63 Elford, W. G. and Robertson, D. S., Measurement of winds in the upper atmosphere by means of drifting meteor trails. II. Journal of Atmospheric and Terrestrial Physics, 4(4/5):271-284, 1953. Unchecked.

B-64 Elford, W. G. (Dept. of Physics, Univ. of Adelaide, S. Australia), Study of winds between 80 and 100 km in medium latitudes. Planetary and Space Science, N. Y., 1(2):94-101, April 1959. 8 figs., tables, 9 refs. DWB--Results of a systematic investigation of winds in the upper atmosphere by the radio observation of drifting meteor trails are described. It is shown that in medium latitudes the diurnal behavior of the winds in this region can be described in terms of three horizontal components of comparable magnitudes; a prevailing component and two oscillatory components with periods of 24 and 12 hrs. The prevailing winds are predominantly zonal and are directed toward the East during most of the year. Large wind gradients are present in summer and winter. In general the periodic components represent anticlockwise rotation of the wind vectors. The seasonal variations in the magnitude and phase of the 24-hr oscillation suggest a direct thermal origin for this component. The amplitude and phase of the 12-hr component vary in a complex manner throughout the year, but the mean amplitude increases with height. (Met. Abst. 11. 12-161)--Author's abstract.

B-65 Ellyett, C. D., The influence of high altitude winds on meteor trail ionization. Philosophical Magazine, London, Ser. 7, 41(318):694-700, July 1950. 2 tables, 3 figs., 16 refs. DWB--Author examines available evidence to show how winds at 80-120 km can account for complex disturbances that appear in meteor trails as shown by radio wave reflections. By comparing characteristics of fading radio waves from ionosphere with fluctuations of radio echoes from meteor trails, it is concluded that some of the ionospheric fading is due to meteor ionization at E region heights. (Met. Abst. 4F-54)--G. J. E.

B-66 Ellyett, C. D. and Davies, J. G., Velocity of meteors measured by diffraction of radio waves from trails during formation. Nature, London, 161(4094):596-597, April 17, 1948. 6 figs., 3 tables. DLC--Using Fresnel's integrals, experimental calculations of the Geminid meteor shower of Dec. 11-13, 1947, and of the Quadrantid shower of Jan. 3-4, 1948, are discussed. Results agree well with visual observations.--W. N.

B-67 Ellyett, C. D. and Fraser, G. J. (both, Canterbury Univ. College, Christchurch, N. Z.), The influence of noise on radar meteor observations. Australian Journal of Physics, Melbourne, 8(2):273-278, June 1955. 2 figs., 18 refs., eq. DWB, DLC--An experimental investigation has been made of the minimum detectable echo power from meteor trails, using radar techniques at 69 Mc/s, with incoherent detection. For optimum signal-to-noise ratio the pulse width must exceed the cathode-ray tube spot width. Extraterrestrial noise is predominant at 69 Mc/s, and the receiver noise figure is found to be of only second order importance. Variations in the effective aerial temperature introduce corresponding variations in the observed meteor rate, and must therefore, be considered when meteor rates are being compared. Using artificial echoes, a minimum detectable signal-to-noise ratio of 8 db is found. The most important parameter is the total received signal energy. Both these results are in agreement with published theories. No further reduction in the size of the smallest observable meteor is likely through receiver improvement. The important features of the receiver are described. (Met. Abst. 8H-53)--Authors' abstract.

B-68 Ellyett, C. D. and Roth, K. W. (both, Canterbury Univ. College, Christchurch, N. Z.), Radar determination of meteor showers in the Southern Hemisphere. Australian Journal of Physics, Melbourne, 8(3):390-401, Sept. 1955. 5 figs., 2 tables, 15 refs. DWB--During the greater part of 1953 a radar survey was made of meteor activity in the Southern Hemisphere. The results are presented, together with a brief description of the apparatus used. Radiants are calculated from daily range-time plots of meteor echoes, and the resulting showers are in accord with data reduced from earlier visual observations. Both radar and visual data for the Southern Hemisphere show many night radiants between mid June and Mid-Aug. Showers in this period are clearly defined but overlap in date, and there is a marked drift in the direction of the meteor activity as the date progresses. Two new Southern Hemisphere daylight showers of moderate strength have been found by radar in June and Oct., respectively, and considerable confused night activity is present in early Dec. The greater proportion of both the Northern and the Southern Hemisphere meteor shower radiants appear to lie close to the plane of the ecliptic. (Met. Abst. 8H-54)--Authors' abstract.

B-69 Ellyett, C. D. (Canterbury Univ. College), Radar-meteor research in New Zealand. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 198-199. 5 refs.) DWB--

A radar survey of Southern Hemisphere meteor activity, covering the year 1953, has been carried out at a new radio field station operated near Christchurch, New Zealand. Measurements have also been made of meteor velocities. It is proposed to repeat the survey of meteor activity during 1955-56, and also to make measurements on the D region of the ionosphere. Coherent pulse apparatus will probably be completed prior to the International Geophysical Year, enabling E region winds to be calculated from the movement of meteor trails. (Met. Abst. 8H-55)--Author's abstract.

B-70 Ellyett, C. D. and Keay, C.S.L., Radio echo observations of meteor activity in the Southern Hemisphere. Australian Journal of Physics, 9:480-491, Dec. 1956.--Most meteoric matter incident on the Southern Hemisphere down to magnitude +4.5 is confined to direct orbits closely following the plane of the ecliptic. Increase of observation sensitivity shows that many of the meteors previously regarded as sporadic represent the upper limits of showers of minor sized particles, which are present during months normally regarded as devoid of showers. --IRE Abstract.

B-71 Endresen, K.; Hagfors, T.; Landmark, B. and Rødsrud, J. (all, Norwegian Defence Res. Establishment, Kjeller, Norway), Observations of angle of arrival of meteor echoes in v.h.f. forward scatter propagation. Journal of Atmospheric and Terrestrial Physics, N. Y., 12(4):329-334, 1958. 5 figs., 8 refs. DLC--Observations of the azimuth angle of arrival of meteor reflections in forward scattering are presented. The properties of background meteor as well as shower meteor reflections are studied. The diurnal variation of the angle of arrival of the meteoric reflections is in good agreement with present theories. (Met. Abst. 10.6-308)--Authors' abstract.

B-72 Eshleman, V. R., The mechanism of radio reflections from meteoric ionization. Stanford University, 1952. (Ph. D. dissertation). Unchecked. Also-issued as Stanford University, Electronics Laboratories, Contract N6onr 251(07), Technical Report No. 49, July 15, 1952.

B-73 Eshleman, R. and Manning, Laurence A., Radio communication by scattering from meteoric ionization. Institute of Radio Engineers, Proceedings, 42(3):530-536, March 1954. 6 figs., 15 eqs. DWB--By a consideration of the amplitude and duration of echoes forward-scattered from individual meteor ionization trails, and of the probability of detecting randomly oriented trails over an oblique radio propagation path, an estimate of the contribution of meteoric ionization to extended range hf and vhf radio transmission has been obtained. It has been concluded that meteoric ionization alone would give a virtually continuous signal for a transmission path of about 1000 km at frequencies near 15 mc. For the very high frequencies, scattering from meteor trails has been found to be at least an important contributing factor to the propagation of a signal over an oblique path. A precise evaluation of the role of this process must await a better determination of the number of trails as a function of their ionization density. (Met. Abst. 6.3-346)--Authors' abstract.

B-74 Eshleman, V. R., The effect of radar wavelength on meteor echo rate. Institute of Radio Engineers, Transactions, AP-1(2):37-42, Oct. 1953. Also issued as: Stanford Univ., Electronics Laboratories Technical Report, No. 59, Feb. 2, 1953. Contract N6onr 251(07). --Gives a theory for the way in which the number of sporadic meteor trails detected varies with radar wavelength and system parameters. Reviews critically the previous theories, especially that of Lovell and Clegg (see ref. no. B-188) and points out some of the errors which have resulted from its use. Presents relations for the ratio of received to transmitted power applicable to both low and high density trails. Introduces a correction, important at high frequencies, for the difference in age of the trail at different positions. Also interpolates between the low and high density cases with the wave solution for a homogeneous column. Compares the final rate wavelength curves with the experiments of McKinley; a close check is found. --L. A. Manning.

B-75 DELETED

B-76 Eshleman, V. R.; Gallagher, P. B. and Peterson, A. M. (all, Radio Prop. Lab., Stanford Univ.), Continuous radar echoes from meteor ionization trails. Institute of Radio Engineers, N. Y., Proceedings, 43(4):489, April 1955. 3 refs. DWB--Radar propagation tests over 500 to 2000 km distances with at 30 to 100 Mc frequencies indicate continuous reflection from areas in E region, which may be explained by (1) scattering from blobs of ionization produced by turbulence, or (2) overlapping of reflections from numerous meteor ionization trails. If the former is the true explanation the maximum power would be received from overhead, whereas if meteor trails are responsible, there would be little chance of reflection from horizontal trails overhead, as these are rare, but would be at a maximum at low angles. Tests made in summer of 1953 at Stanford on 23 Mc showed no returns at vertical angle, but continuous returns on 45° angle and 140 km range. Conclusion is that meteor ionization plays dominant role in long range VHF propagation. (Met. Abst. 8H-56)--M. R.

B-77 Eshleman, V. R., Meteors and radio propagation. Pt. A: Meteor ionization trails. Their formation and radio-echoing properties. Pt. B: Characteristics of continuous and intermittent radio signals propagated by meteor trails. Pt. C: Security aspects of meteor propagation. Stanford University, Electronics Laboratories, Contract N6onr 25132, Technical Reports No. 44, 45 and 46, 1955. Unchecked.

B-78 Eshleman, V. R.; Manning, L. A.; Peterson, A. M. and Villard, O. G., Jr., The role of meteors in extended range VHF propagation. Institute of Radio Engineers, Convention Records, Pt. 1:61-62, March 1955. Unchecked.

B-79 Eshleman, V. R., Short wave length radio reflections from meteoric ionization. Pt. 1: Theory for low density trails. Stanford University, Electronics Laboratories, Contract AF 19(604)-1031, Scientific Report, No. 5, Aug. 1956. Unchecked.

B-80 Eshleman, V. R. and Mlodnosky, R. F., Directional characteristics of meteor propagation derived from radar measurements. Institute of Radio Engineers, Proceedings, 45(12): 1715-1723, Dec. 1957. 11 figs., 17 refs., 5 eqs. DLC--The directivity of radio reflections from meteor trails and the distribution of trail orientations (radiants) control the directional properties of meteor propagation. Because of the geometrical correspondence between radar and oblique path detection of meteors, the directional properties of meteor propagation can be determined from the range and azimuth distributions

of the echoes detected by a radar system. The gross features of these directional properties for an east-west path in northern temperate latitudes are such that (for maximum circuit duty cycle product of number of echoes and their average duration) the antenna beams at the transmitter and receiver should be pointed north of the great circle bearing during the morning hours and south of this bearing during the evening. The optimum off-path angle may vary from a few degrees to greater than 20°. For a north-south path, the beams should be pointed west of the path at night and east of the path during the day, for maximum duty cycle. These gross features appear to repeat each day. In addition, short-term fluctuations in the radiant distribution have been noted, some of these fluctuations presumably being due to heretofore undetected meteor showers of very short duration. It appears that the information capacity of meteor burst and ionospheric scatter communication systems could be markedly increased by varying the bearings of the antenna beams according to the known diurnal variations in meteor radiants. In addition, it may be possible to utilize the short-term fluctuations in the radiant distribution by means of a radar which can monitor continuously the changing radiant distribution and "instantaneously predict" the optimum antenna bearings for the communication circuit. (Met. Abst. 9H-23)--Authors' abstract.

B-81 Eshleman, V. R.; Gallagher, P. B. and Mlodnosky, R. F., Meteor rate and radiant studies. Stanford University, Electronics Laboratories, Contract AF 19(604)-1031, Final Report, Feb. 1957. Unchecked.

B-82 Eshleman, V. R., On the wavelength dependence of the information capacity of meteor-burst propagation. Institution of Radio Engineers, Proceedings, 45(12):1710-1714, Dec. 1957. 2 tables, 16 refs., 4 eqs. DLC--Ionospheric scatter propagation and meteor burst propagation are discussed comparatively. The wavelength dependence of information capacity of the former is about λ 2.7 and for the latter about λ 4.7, which also has the advantage of more efficient use of the fluctuating signal. Its disadvantages are relatively few and are surpassable.--W. N.

B-83 Eshleman, V. R., Some characteristics of radio communication via meteor ionization trails. AGARDograph, Paris, No. 26:15-26, July 1957. 2 figs., 2 tables, 15 refs. DWB (629.1322 N864a)--Since 1950, efforts have been made, especially in Canada, at Manchester and Stanford Univ., to use meteor ionization trails for radio propagation. Successful demonstration is credited to the group at the Radio Physics Lab. of the Canadian Defence under direction of P. A. FORSYTH since

1953. The question of bursts vs. continuous scatter propagation over the same path (to and from meteor trails) is discussed. Advantages of bursts at shorter wave lengths (6 to 3 or less meters) are discussed in terms of interference and availability of space, higher gain and movable antennas. Diurnal changes in meteor radiant distribution are discussed. Continuous radar monitoring of radiant distribution could provide instantaneous propagation predictions. (Met. Abst. 10.1-351)--M. R.

B-84 Eshleman, V. R., The theoretical length distribution of ionized meteor trails. Journal of Atmospheric and Terrestrial Physics, 10(2):57-72, Feb. 1957. 13 figs., 16 refs., 21 eqs. DWB--Lengths of ionization columns formed by meteors are found to depend on the mass of the meteor and its angle of approach (radiant) into the upper atmosphere. Modal trail length is estimated as 12 sec ζ km for sporadic meteors and 17 sec ζ for shower meteors, where ζ is zenith angle of radiant. Most likely trail length for sporadic meteors is 15 km, but detection by a radar system favors longer trails, and most likely length of trails detected by a radar system with broad beam antenna is about 25 km, in agreement with experiment. (Met. Abst. 8.6-353)--From author's abstract.

B-85 Eshleman, V. R., Meteor scatter. (In: Menzel, Donald H., ed., The radio noise spectrum. Cambridge, Mass., Harvard Univ. Press, 1960. p. 49-78. 9 figs., 2 tables, 61 refs., 19 eqs.) DWB (621.38411 M551ra), DLC--Meteor scatter is an important mode of propagation at frequencies from about 20 to several hundred megacycles per second. From a consideration of the mechanism of radio wave scattering by individual trails and the number and directional characteristics of meteor particles, it is possible to determine the characteristics of the total meteor scatter signal. From this knowledge system parameters may be chosen to maximize the meteor signal (ionospheric scatter and meteor burst communication systems) or to minimize its effect (where the meteor scatter mode interferes with the desired operation of the system). --E. Z. S.

B-86 Evans, S., Scale heights and pressures in the upper atmosphere from radio-echo observations of meteors. Royal Astronomical Society, Monthly Notices, 114(1):63-73, 1954. 5 figs., 4 tables, 12 refs., 13 eqs. DWB--The method developed by KAISER was applied to a number of meteor showers at Jodrell Bank. Pressure p at characteristic height H is given by:

$$\log_{10} p = 11.42 + \frac{1}{3} \log_{10} H - 2 \log_{v}$$

Log p (dynes. cm^{-2}) calculated by this equation is plotted against height, increasing from -0.1 at 99 km to +0.65 at 88 km. Atmospheric densities calculated for the same range exceed those given by rocket data at New Mexico but the difference is only of the order of the standard deviation. They are considerably less than those given by photographic meteor observations over Massachusetts. (Met. Abst. 6.6-239)--C.E.P.B.

B-87 Evans, S. (Jodrell Bank Exp. Station, Univ. of Manchester), Atmospheric pressures and scale heights from radio echo observations of meteors. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 86-91. 7 figs., 21 refs., 6 eqs.) DWB--The distribution of heights of meteors observed on radio echo equipment has been shown to depend significantly only on the mass distribution of the incident meteors and the atmospheric scale height. At altitudes of the order of 100 km, values of the scale height are derived from the width of the height distributions and values of atmospheric pressure at the maxima of the distributions are obtained from the meteor evaporation equations. A comparison of these results with those obtained from photographic meteor and rocket observations is felt to be valid since the same parameters are required in the evaporation equations used in photographic and radio meteor theory. The present results are not significantly different from those obtained in New Mexico and geographical variations therefore appear to be small. Seasonal variations in the height of a given pressure level are of the order of ± 1 km which is little greater than the probable error. Possible diurnal and semidiurnal variations both having an amplitude of the order of ± 1 km have been found. (Met. Abst. 8H-57)--Author's abstract.

B-88 Evans, S. and Hall, J. E. (both, Jodrell Bank Experimental Station, Univ. of Manchester), Meteor ionizing and luminous efficiencies. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 18-22. 2 figs., 2 tables, 12 refs., 6 eqs.) DWB--Simultaneous radio and visual observations of meteors made at Jodrell Bank have been used to estimate the ratio of luminous to ionizing efficiency in the meteor evaporation process. A comparison of the results obtained from observations made during the Perseid and Geminid showers shows this ratio to vary little with meteor velocity. The ionizing efficiency is related to the probability of ionization of a single evaporated meteor atom. Evidence is presented which suggests that this probability may approach unity and that it has only a small velocity dependence. (Met. Abst. 8.3-327) --Authors' abstract.

B-89 Fedynskii, V. V., Rezul'taty nabliudenii meteornykh sledov v Tadshikistane (1934-1938). (Results of observations of meteor trains in Tadzhikistan (1934-1938).) Astronomicheskii Zhurnal, Moscow, 21(6):291-306, 1944. 2 figs., 57 refs., tables, eqs. English abstract, p. 305-306. DLC--Forty-one night meteor trains observed systematically. A number show drifts of order of 1000 km/hr. Average velocity was 391 km/hr. (Met. Abst. 4F-28)--G. J. E.

B-90 Fedynskii, V. V. (Meteor and Comet Commission, Astronomical Council, Academiia Nauk, SSSR), Meteor studies in the Soviet Union. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 188-192. 2 tables, 26 refs.) DWB--Meteors have been studied for 150 years by Russian astronomers, and more than 150 papers and 3 monographs on meteors have been published in the last 30 years. Systematic observations have been made at Stalinabad, Tadjik-Ashkhabad, Turkmenistan (38°N) where weather conditions are good for observation; and also at Odessa and Moscow, Leningrad, Gorky, Lvov, etc. on a smaller scale. Conferences are held every 2 years. Visual observations of 39,000 meteors were made by ASTAPOVITCH. Photos and spectra have been obtained since the early part of the century. Studies of meteoric effects on atmosphere, ionosphere and earth are reported, as well as studies of atmospheric effects on meteors. (Met. Abst. 8H-58)--M. R.

B-91 Ferrel, O. P., Meteoric impact ionization observed on radar oscilloscopes. Physical Review, 69 2nd Ser. (1/2):32-33, Jan. 1 and 15, 1946. fig., 7 refs.--Brief note summarizing development related to radio effects and ionization dissipation of meteors, including some observations with a 105 Mc/s radar which gave echoes of 1/2 to 3 sec duration at 30 to 125 km paths. Future trend of investigation and aims are mentioned.--W. N.

B-92 Feinstein, J., The interpretation of radar waves from meteor trails. Journal of Geophysical Research, 56(1):37-51, March 1951. 4 figs., table, 9 refs., 7 eqs. DLC--Electromagnetic wave theory is applied to various cylindrically symmetric distributions of electron density to ascertain the dependence of reflected radio signals upon the system parameters. Results are expressed in terms of the average effective dielectric constant, the circumference/wave-length ratio of the cylinder, and the incident wave polarization. Two models have been mainly considered -- a linear radial variation of electron density, and a constant density distribution. The general properties and dependences of the echoes are summarized for each major region of trail parameters, and the transitional characteristics are indicated. A qualitative comparison of these results with published observational data leads to a new picture of the trail decay period. (Met. Abst. 8I.111)--Author's abstract.

B-93 Fialko, E. I., An approximate estimation of the probability of meteoric ionization. Soviet Astronomy AJ, New York, 3(3):479-483, Dec. 1959. Translation of original Russian in Astronomicheskii Zhurnal, Moscow, 36(3):491-495, May/June 1959. 17 eqs., 15 refs. --An approximate estimation is made of the exponent n, which characterizes the relation of the probability of ionization to meteor velocity. --Author's abstract.

B-94 Fialko, E. I. (Tomsk Polytechnic Inst.), A method for studying the distribution by mass of meteoric bodies. Soviet Astronomy AJ, New York, 3(6):970-973, May/June 1960. fig., 10 refs., 11 eqs. Transl. of Metod issledovaniia zakona raspredeleniia meteornykh tel po massam. Astronomicheskii Zhurnal, Moscow, 36(6):1058-1060, Nov./Dec. 1959. DLC--The method outlined may be used to study the mass distribution pattern of meteoric bodies, by utilizing the distribution by duration of persistent radio echoes returned from meteor trails. Experimental results from the application of this method to the Perseid shower are presented. (Met. Abst. 11.12-153)--Author's abstract.

B-95 Fialko, E. I., Metod otsenki koeffitsienta diffuzii v meteornoi zone. (Method of estimating the diffusion coefficient in a meteoric zone.) Radiotekhnika i Elektronika, Moscow, 4(7):1208-1210, July 1959. 2 figs., 3 refs., 4 eqs. DLC--The coefficient of meteor mass distribution may be obtained both from the distribution of transient radio echo duration and from the distribution of stable radio echo duration. From the coefficients of mass distribution obtained by the two different methods, the diffusion coefficient may be obtained. The formulas to be used are derived in this paper. It is also noted that since the diffusion coefficient is a function of height, for typical heights the dependence of the diffusion coefficient on meteor velocity may be obtained. Results of meteor echo observations at 10 m wavelength (Tomsk, Jan. 9, 1957) are presented; they yield a diffusion coefficient of 2.8 m^2/s at 90 km height, corresponding to a meteor velocity of 28 km/s. --G.T.

B-96 Fialko, E. I., O veroiatnosti meteornoi ionizatsii. (Probability of meteoric ionization.) Radiotekhnika i Elektronika, Moscow, 4(7):1206-1208, July 1959. 4 figs., 12 refs. DLC--

The probability of ionization (β) is defined as "the probability of the production of a free electron as a result of the evaporation of one meteoric atom and its collision with atmospheric particles". The dependence of this probability upon meteoric velocity (v) may be expressed as (v) av^n, where a and n are constants (for n, different values between 0 and 5.6 have been obtained empirically). In this paper a study of the relationships between meteor velocity, the n coefficient, intensity of initial radar signal and radar wave length is reported and shown graphically. The largest number of meteors was found to register at meteoric velocities of 55 km/s (8.13 m wave length; n = 1.5). Visual meteor observations were used to determine the selectivity of radar detection. --G. T.

B-97 Fialko, E. I., Distribution of meteor radio echoes by duration. Pt. I: Reflection from stable trails. Soviet Astronomy AJ, New York, 3(5):842-848, March/April 1960. 3 figs., 4 refs., 40 eqs. Translation of original Russian in Astronomicheskii Zhurnal, Moscow, 36(5):867-873, Sept./Oct. 1959. DLC--Analytical expressions are derived for (1) the general case; (2) from the region of the characteristic height; and (3) where the atmospheric pressure is far lower. Good agreement between theoretical and practical results; the latter dependent on directional properties of the antenna. --W. N.

B-98 Fialko, E. I., Mean hourly rate of meteors recorded by radar. Pt. I; Meteor stream. Soviet Astronomy AJ, New York, 3(4): 612-614, Jan./Feb. 1960. fig., 6 refs., 13 eqs. Translation of original Russian in Astronomicheskii Zhurnal, Moscow, 36(4):626-628, 1959. DLC--A general expression is derived for the number of meteors detected by radar under conditions of normal reflection (scattering) of radio waves by an ionized trail in the case of a meteor stream. A simplified formula for calculations was deduced. --Author's abstract.

B-99 Filipowsky, Richard T., comp. (Bibliography on transmission characteristics of various propagation media. Burbank, Calif., Collins Radio Co., (1960?).) Unpaged. Looseleaf. 991 refs. published 1932-June 1959, arranged in classed subject order, and chronologically thereafter. No author index.

B-100 Flood, Walter A. (Cornell Aeronautical Lab., Inc., Buffalo, N. Y.), Meteor echoes at ultra-high frequencies. Journal of Geophysical Research, Wash., D. C., 62(1):79-91, March 1957. 5 figs., 28 eqs. DLC--It is proposed that, at ultra-high frequencies, under-dense meteor echoes have an effective scattering length L, which is much less than a Fresnel zone. Consequently, UHF meteoric echoes may be analyzed in terms of

Fraunhofer diffraction theory, resulting in a relaxation of the requirement that a meteor trail be perpendicular to the radar line-of-sight before an echo can be received. Formulas for the back scattered power, time duration, and echo rate are deduced. (Met. Abst. 8H-93)--Author's abstract.

B-101 Forsyth, P. A.; Hines, C. O. and Vogan, E. L., Diurnal variations in the number of shower variations detected by the forward-scattering of radio waves, Pt. 2, Experiment. Canadian Journal of Physics, Ottawa, 33(10):600-606, Oct. 1955. 4 figs., 5 refs. DWB, DLC. (For abstract on Pt. 1 and 3, see ref. No. 143 and 150.)--The theory developed in the preceding article is applied to derive the expected diurnal variations of the meteor signal rate for four showers as observed by means of a particular forward-scatter transmission path (Cedar Rapids - Ottawa). These results are then compared with the experimental signal rates. The good agreement obtained indicates that the approximations inherent in the theory are sufficiently accurate for practical purposes. The results also indicate that very few meteors, if any, are observed under conditions which do not satisfy the requirements for specular reflections. (Met. Abst. 8H-59)--Authors' abstract.

B-102 Forsyth, P. A. and Vogan, E. L., Forward-scattering of radio waves by meteor trails. Canadian Journal of Physics, Ottawa, 33(5):176-188, May 1955. 7 figs. (incl. photos), table, 15 refs. DWB--Radio waves which are too high in frequency to be reflected by the ionospheric layers are often reflected back to the earth's surface by the ionization in meteor trails, and may be detected at distances of the order of 1000 km from the transmitting station. These forward scattered signals have been studied by the use of several transmission paths in Canada. The paper summarizes the characteristics of the individual signals and presents some preliminary results of the investigation. It seems likely that the technique will prove to be useful in meteoric studies. (Met. Abst. 7.11-291)--Authors' abstract.

B-103 Forsyth, P. A.; Vogan, E. L.; Hansen, D. R. and Hines, C. O., The principle of JANET---a meteor burst communication system. Institute of Radio Engineers, Proceedings, 45 (12):1642-1657, Dec. 1957. 20 figs., 42 refs., 7 eqs. DLC --The present state of the Canadian VHF system, its propagation characteristics and design, is discussed, including experimental operation results. --W. N.

B-104 Furman, A. M., K teorii ionizatsii meteornykh sledov, I, Kinetika izmeneniia ionizatsionnyykh parametrov meteornykh tel pri ikh razogreve vo vremia dvizheniia v atmosfere Zemli. (Theory of ionization of meteor trails, Pt. 1, The kinetics of the variation of the ionization parameters of meteor bodies during their motion in the Earth's atmosphere.) Astronomicheskii Zhurnal, Moscow, 37(3):517-525, May/June 1960. 5 tables, 18 refs., 12 eqs. Russian and English summaries p. 517. Transl. into English in Soviet Astronomy AJ, New York, 4(3), 1960. DLC--It is shown that the ionization parameters (i.e. the work function of the electron, positive ion, ionization potential of the atom and the probability of evaporation of a neutral atom) of a meteor body vary as it heats up during its motion in the earth's atmosphere and as its fractions with lowest boiling points evaporate. The oxides, alkaline and alkaline-earth metals contained in stony and iron-stony meteors provide for the low values of the work function of the electron and positive ion. As a result of the process of continuous "blowing-off" of particles from the surface of a meteor body by the encountered flow of gas molecules, which excludes the formation of space charges and due to the emission of charged particles of both signs, dynamic equilibrium between emission intensities of electrons and positive ions sets in. Directions for the computation of equilibrium values of the work function for electrons and positive ions are given. The noted circumstances give grounds for the reconsideration of existing concepts on the theory of ionization of meteor trails. (Met. Abst. 11.12-158)--Author's abstract.

B-105 Gallagher, P. B., An antenna array for studies in meteor and radio astronomy at 13 meters. Institute of Radio Engineers, Proceedings, 46(1):89-92, Jan. 1958. 4 figs., 4 refs. DLC--Design and some experimental results obtained with the antenna at Stanford Univ. are discussed. The equipment, when fully completed, will permit studies of meteors at the 15th visual magnitude, and to determine number, velocities, orbits and distribution of meteoric particles 100 times lighter than heretofore studied by radar.--W. N.

B-106 Gill, J. C. and Davies, J. G., A radio echo method of meteor orbit determination. Royal Astronomical Society, Monthly Notices, 116(1):105-113, 1956. 4 figs., plate, table, 11 refs. DWB--A radio echo system using three receivers spaced 4 km apart has been used to determine the orbits of individual meteors. About 200 orbits can be calculated from the meteor echoes photographed during a 24 hr period of observation. An analysis of Geminid meteors observed in 1954 indicates that the accuracy obtainable is limited to about $\pm$ 2 km/sec in velocity by atmospheric deceleration, and to $\pm$ 3° in radiant position by turbulent winds in the meteor region. (Met. Abst. 8.7-153)--Authors' abstract.

B-107 Gormley, P. M., High weather. Aero Digest, 61(5):30-31, 105-107, Nov. 1950. 5 figs. DLC--Methods of determining winds at very high altitudes are discussed and illustrated. Balloons reach 100,000 ft and rockets 250 miles (but rockets are useless for determining winds). Observations of noctilucent clouds or of meteor trails give occasional information on winds at certain altitudes, but recently measurements of the movement of sporadic E layer ionic drift have given more consistent results. Radar reflections from drifting meteoric dust clouds give a Doppler effect (interference) arising from winds of high speeds in the stratosphere. Methods used for measurements of ionic or meteoric drift by radar are shown diagrammatically. (Met. Abst. 2.4-117)--M.R.

B-108 Greenhow, J. S., The fluctuation and fading of radio echoes from meteor trails. Philosophical Magazine, London, 41(318): 682-693, July 1950. 10 figs., tables, 8 refs. DLC--Fluctuations of periods 0.01 and 0.1 sec were observed on 36 to 72 Mc/s radio wave frequency. Author arrives at the conclusion that the phenomenon is due to wind gradient in the high atmosphere causing a break-up of the trail of meteor ionization. Hence, formation of several reflecting regions. (Met. Abst. 4F-60)--W.N.

B-109 Greenhow, J. S., A radio echo method for the investigation of atmospheric winds at altitudes of 80 to 100 km. Journal of Atmospheric and Terrestrial Physics, London 2(5):282-291, 1952. 8 figs., 10 refs. DWB--The setup is described for recording echoes on 8.4 m from meteor trails. Winds deduced from drift of echoes had velocities around 50 m/sec, mainly from N before 0100 local time and from S after 0200. The distortion shows steep wind gradients superposed on this steady drift so that points 5 - 10 km apart may differ by over 50 m/sec. (Met. Abst. 4.2-7)--C.E.P.B.

B-110 Greenhow, J. S., Characteristics of radio echoes from meteor trails, Pt. 3; The behaviour of the electron trails after formation. Physical Society of London, Proceedings, B, 65:169-181, 1952. (For abstracts on Pt. 1, 2, and 4, see ref. no. 188, 21, and 13) 10 figs., 2 plates, 17 refs., 11 eqs. DWB--Amplitudes of long duration echoes from meteor trails show, superposed on steady decrease due to diffusion, fluctuations of period 0.04 to 0.4 sec (at 8.4 m), attributed to distortion of the trail by turbulence. Turbulent winds of about 20 m/sec are inferred at heights of 80-100 km. (Met. Abst. 4F-99)--C.E.P.B.

B-111 Greenhow, J. S. and Hawkins, G. S., Ionizing and luminous efficiency of meteors. Nature, London, 170(4322):355-357, Aug. 30, 1952. 2 figs., 13 refs., 6 eqs. DWB--Revised calculations of the heat production, luminous efficiency and ionization of the air by meteors show that ionization is much greater than previously supposed (from 10^{13} electrons/sec at zenith magnitude + 3 to nearly 10^{15} at -4) in fair accord with theory. Radio echoes of short duration arise from meteors below visibility limit; all visible meteors produce long duration echoes. (Met. Abst. 4.2-273)--C.E.P.B.

B-112 Greenhow, J. S., Systematic wind measurements at altitudes of 80-100 km using radio echoes from meteor trails. Philosophical Magazine, London, 7th Ser. 45(364):471-490, May 1954. 12 figs., 4 tables, 13 refs.--Measured winds by the meteor Doppler method, using a coherent pulse technique similar to that of Manning, Villard, and Peterson .(see ref. no. B-218, 220). Gives a block diagram of the system, which includes two 90 degree phase shifted output channels for sense of drift determination, as well as an amplitude output channel for signal strength and range, measurement. The direction in which echoes are received is fixed by choice of one of two 12 degree Yagis directed at right angles. Photographic records are obtained of echo range, amplitude, and phase (in two 90 degree channels). Shows ten sample records. Describes results of measurements during September and October, 1953; about 3500 usable meteors were recorded per day. Plots vector winds versus hour for Sept. 17-18, 1953, and shows a twice daily rotation of the wind direction in N to E sense. Makes a harmonic analysis of the NS and EW velocity components for five days, and tabulates the resulting prevailing, diurnal, and semi-diurnal velocities. The prevailing (daily mean) vector velocity varied with date from 7 to 21 m/s in varied directions. The measured amplitude of the diurnal and semi-diurnal components fluctuated considerably from day to day; the semi-diurnal component was found from 7 to 41 meters/second, the diurnal from 1 to 13 m/s. The 12 hour component was maximum to the north between 0000 and 0400 local time, and 24 hour component from 0930 to 1230. Analyzed the data to see if the winds are horizontal by dividing the radial velocity components by the cosine of the echo elevation angle; the resulting function is nearly constant as elevation angle (estimated from range and height) is varied. Estimated the height of exponential type echoes from the duration (a function of diffusion coefficient). Found a linear increase of mean wind speed from 14 m/s at 78 km to 60 m/s at 98 km. Points out the need to correct diurnal velocities for the diurnal echo height variation. From the spread in radial velocity values about the mean, finds that sometimes there is either variability, or height stratification (conflicts in statements as to which it is). Shows the winds are generally consistent with those measured by the same method at Stanford University and the University of Adelaide. Comparison with fading wind measurements at Cambridge leads to the conclusion the latter must apply to heights above 100 km. --L. A. Manning.

B-113 Greenhow, J. S. and Neufeld, E. L., The diffusion of ionized meteor trails in the upper atmosphere. Journal of Atmospheric and Terrestrial Physics, 6(2/3):133-140, March 1955. 7 figs., 2 tables, 13 refs., 4 eqs. DWB--Between 80 and 100 km, duration of radio echoes from meteor trails decreases nearly exponentially. Records on 8.27 and 4.35 m are shown and compared with theory. Log (diffusion coefficient) is plotted against height and after correction agrees well with theoretical curve. Approximate estimates of meteor heights may be made from echo durations. (Met. Abst. 6.6-344)--C.E.P.B.

B-114 Greenhow, J. S. and Neufeld, E. L., The height variation of upper atmospheric winds. Philosophical Magazine, Ser. 8, 1(12):1157-1171, Dec. 1956. 9 figs., 11 refs. DWB--Radio echoes from meteor trails are especially suitable for determining wind profiles at 85-100 km. Observations at Jodrell Bank in 1954-55 giving N and E components are described. Diurnal variation shows a well marked 12 hr wave and a smaller 24 hr wave, both increasing upwards. The annual variation of the 12 hr wave is shown by hannonic dials. The change of amplitude of the 12 hr wave over 10 km height in winter is 20-30 m/s in both N and E components at 90-100 km but much less at 85-95 km; it decreases nearly to zero in summer. The rate of phase change of 12 hr component also decreases from winter (7°/km) to summer (3°/km). At 100 km wind is toward E in summer and winter and toward W in spring and fall, but at 85 km it remains E in fall. The 12 hr oscillation is compared with theoretical height variations due to thermal and tidal effects of the sun (after Wilkes) and with observations at other levels; agreement is good. It is inferred by extrapolation that the dynamo region in temperate latitudes is at a height of about 135 km. (Met. Abst. 8.4-245)--C.E.P.B.

B-115 Greenhow, J. S., Meteor trail measurements by radio detection means. Jodrell Bank Experimental Station (of Univ. of Manchester), Cheshire, England, Contract AF 61(514)-948, Technical Note, No. 1, May 1, 1956-April 30, 1957. 17 p. 4 figs., 11 refs. DWB (M90.25 T63te)--The reflection of radio waves from the ionized trails produced by meteors as they burn away in the upper atmosphere is discussed. In particular the process of evaporation of meteor atoms is considered in relation to upper atmosphere pressures and temperatures. Expressions relating atmospheric pressure at the point at which a meteor produces its maximum ionization, to meteor velocity and other physical properties of meteors are given. It is shown that measurements of pressure, density and temperature in the region 80 to 100 km above the earth can be made by observations of the heights of reflection of meteor echoes. As sporadic meteors occur at all times of the day and night, this method enables the diurnal and seasonal variations of the physical properties of the atmosphere between altitudes of 80 and 100 km to be studied in detail. The design of a sensitive radar equipment operating at a wavelength of 8.2 m is discussed and sections are devoted to the transmitter, receivers, display and aerial systems. The accuracy of height determination is shown to be of the order of $\pm$ 2 km. The expected usable echo rate is approximately 200/day, an order of magnitude increase over the echo rate with the existing 4 m equipment. It should therefore, be possible to obtain mean atmospheric profiles in one or two days' observing time, and to observe diurnal variations by integrating approximately fourteen days observations. (Met. Abst. 9H-125)--Author's abstract.

B-116 Greenhow, J. S. (Univ. of Manchester, England), Eddy diffusion and its effect on meteor trails. Journal of Geophysical Research, Wash., D. C., 64(12):2208-2209, Dec. 1959. 2 figs., ref. DLC--Information about the small-scale turbulence at heights near 90 km has been obtained from photographic meteor trails. The time constant of the smallest eddies is found to be approximately 30 sec, and the turbulence power to be 70 ergs $g^{-1}\ sec^{-1}$. --Author's abstract.

B-117 Greenhow, J. S. and Neufeld, E. L. (both, Jodrell Bank Experimental Station, Manchester Univ., England), Measurements of turbulence in the 80 to 100 km region from the radio echo observations of meteors. Journal of Geophysical Research, Wash., D. C., 64(12):2129-2133, Dec. 1959. 5 figs., 8 refs., 5 eqs. DLC--Measurements of irregular winds at heights of 80 to 100 km, using radio echoes from meteor trails, are described. Large irregularities with a vertical scale of 6 km, a horizontal scale of the order of 150 km, and a time constant of 6, 10^3 sec are observed. The rms wind velocity associated with these irregularities is 25 m sec^{-1}. Turbulent wind shears of the order of 10 m $sec^{-1}km^{-1}$ are found, although occasionally shears as high as 100 m sec^{-1} km^{-1} are observed. Lower limits for the scale and time constant of the smallest eddies are determined. --Authors' abstract.

B-118 Greenhow, J. S. and Neufeld, E. L. (both, Univ. of Manchester, Jodrell Bank Experimental Station), Turbulence at altitudes of 80-100 km and its effects on long-duration meteor echoes. Journal of Atmospheric and Terrestrial Physics, N. Y., 16(3/4):384-392, Nov. 1959. 4 figs., 11 refs., 6 eqs. DWB, DLC--The two theories of long-duration radio echoes from meteor trails based on scattering from an over-critically dense ionized column, and incoherent scattering from a trail rendered underdense by small scale turbulence are compared. Examination of the characteristics of enduring meteor echoes shows that the incoherent scattering theory is untenable, if small scale turbulence with a time contact of only 0.4 sec is assumed to be present. All the phenomena observed during the lifetime of a long duration meteor echo are readily explained on the basis of multiple reflections from overdense trails. The time constant and scale of the smallest eddies at heights of 80-100 km are shown to be at least 30 sec and 30 m, respectively. (Met. Abst. 11.7-304)--Authors' abstract.

B-119 Greenhow, J. S. and Hall, J. E. (both, Jodrell Bank Experimental Station), The importance of initial trail radius on the apparent height and number distributions of meteor echoes. Royal Astronomical Society, London, Monthly Notices, 121 (2):183-196, 1960. 12 figs., table, 19 refs. --Some simultaneous radio echo observations of meteors at wavelengths of 8 m and 17 m are described. It is shown that very many more echoes from faint + 6 mag meteors are observed at 17 m than at the shorter wavelength, and this effect is attributed to an attenuation in echo amplitude due to the large initial radii of the ionized trails. The initial radius is found to increase from 1 m to 3 m between the heights of 90 and 115 km. It is estimated that radio echo equipment of moderate sensitivity detect only 1.5% of +6 mag meteors at a wavelength of 4 m, 8% at 8 m, rising to 40% at 17 m. The influence of this large attenuation in echo amplitude on metre wave radio echo observations of meteor height, mass, and velocity distributions is considered.--Authors' abstract.

B-120 Greenhow, J. S. and Neufeld, E. L., Turbulence in the lower E region from meteor echo observations. (In: International Union of Pure and Applied Physics, Solid state physics in electronics and telecommunications: proceedings of Conference, Brussels, 1958. pub. London, Academic Press, 1960. p. 493-504. DLC.

B-121 Griffiths, H. V.; Martingell, S. E. and Bayliff, R. W., Meteor whistles. Nature, London, 161(4091):478-479, March 27, 1948. 2 refs. --Description of whistle characteristics as observed before and after 1940 when radio direction finding equipment became available. Highlights of observational results are given. --W. N.

B-122 Groves, G. V. (Dept. of Physics, Univ. College, London), A theory for determining upper atmosphere winds from radio observations on meteor trails. Journal of Atmospheric and Terrestrial Physics, N. Y., 16(3/4):344-356, Nov. 1959. 2 figs., 2 refs., 35 eqs. DWB, DLC--Least squares theory is applied to observations on drifting meteor trails to obtain the determination of a general number of parameters, characterizing the wind structure. The results enable vertical air motion and time and height variations in the wind structure to be examined, whereas previously a constant horizontal wind was assumed. It is shown how, on the basis of the least squares solution, the errors in the parameters, and hence, in the calculated wind structure, can be estimated. The method is applied to a typical set of data. (Met. Abst. 11. 7-129)--Author's abstract.

B-123 Hagfors, T., Forward scatter communication via meteor trails and related problems. AGARDograph, Paris (No. 26?): 69, 1957. AD 159-935. Unchecked.

B-124 Hagfors, Tor, Some statistical results on reflections from meteoric trails obtained by forward scatter experiments in Norway. AGARDograph, Paris, No. 26:27-38, July 1957. 7 figs., 5 refs. DWB (629.1322 N864a)--Results of an investigation of the meteoric component of the VHF scatter signal received over a 1200 km path are presented. The following properties are analyzed: (a) Total percentage of time during which the signal exceeds certain fixed levels; (b) The distribution of duration of the meteor bursts above some particular levels; (c) The distribution of time intervals between meteor echoes. Finally some deductions are made about the mass distribution of random meteors and about the constant of molecular diffusion at the height of meteor reflections. The meteoric signal is compared with the signal due to turbulent fluctuations of electron density.--Author's abstract.

B-125 Hagfors, T. and Landmark, B. (Norwegian Defence Res. Estab., Kjeller, Norway), Observations of direction of arrival of long duration meteor echoes in forward scatter propagation. Journal of Geophysical Research, Wash., D.C., 64(1):19-22, Jan. 1959. 4 figs., 5 refs. DLC--The angular distribution of enduring meteor bursts in forward scattering is studied and compared with the angular distributions observed for the short duration meteor bursts and the turbulent background component. It is concluded that the enduring, fading bursts are due to meteor trails which reflect in a specular manner throughout the time during which they can be observed. (Met. Abst. 11.10-113)--Authors' abstract.

B-126 Barrington, R. E. and Nishizaki, T. (both, Defence Res. Board, Ottawa), Whistler dispersion and exospheric hydrogen ions. Journal of Geophysical Research, Wash., D. C., 65 (9):2581-2582, Sept. 1960. 2 refs. eq. Summary only. A detailed account of this will soon appear in Canadian Journal of Physics. DLC--Accurate measurements show that the variation of whistler dispersion with frequency is of the form predicted by STOREY for an exosphere consisting largely of ionized hydrogen. From these measurements the height at which protons become sufficiently numerous to affect the whistler dispersion is estimated to be 1000 km. --Authors' abstract.

B-127 Hartsfield, W. L. (Central Radio Propag. Lab., Natl. Bur. of Standards, Wash., D. C.), Observations of distant meteor trail echoes followed by ground scatter. Journal of Geophysical Research, 60(1):53-56, March 1955. 3 figs., table, 3 refs. DWB--Observations of backscatter on 13.7 Mc over a southeasterly path from Sterling, Virginia, revealed the existence of meteor trail reflections just ahead of the main body of the backscatter, demonstrating that the latter was from the ground in these instances. The existence of apparent two-hop backscatter without the appearance of one-hop was noted in a number of cases. Possible reasons for this behavior are discussed. (Met. Abst. 6.8-331)--Author's abstract.

B-128 Hawkins, Gerald S., A radio echo survey of sporadic meteor radiants. Royal Astronomical Society, Monthly Notices, 116 (1):92-104, 1956. 10 figs., table, 10 refs., 9 eqs. DWB--Radio echoes have been observed in two narrow beam aerials over the period Oct. 1949 to Sept. 1951. An analysis of the hourly rate of echoes has given a measure of the radiant points of sporadic meteors. The radiants are found to be concentrated toward the plane of the ecliptic in the directions of the apex, Sun and antihelion points. The majority of meteors in space are moving in direct orbits about the Sun, and there is a dense complex of orbits in the region traversed by the Earth during the months May to Aug. (Met. Abst. 8.7-157)--Author's abstract.

B-129 Hawkins, Gerald S. (Harvard College Obs., Cambridge, Mass.), Radar echoes from meteor trails under conditions of severe diffusion. Institute of Radio Engineers, N. Y., Proceedings, 44(9):1192, Sept. 1956. 2 figs., table, 7 foot-refs., 7 eqs. DLC--A simple expression is deduced for the power of the radio echo from a meteor trail when diffusion of the trail is predominant. It is shown that the echo is proportional to the 6th power of the wavelength and inversely proportional to the 4th power of the range. For a given meteor velocity there is a critical height above which the effects of diffusion become serious. The diffusion ceiling is given for the various wavelengths between 0.5 m and 16 m. (Met. Abst. 8H-102)--M. R.

B-130 Hawkins, G. S. and Wonter, D. F. (both, Harvard College Obs.), Radar echoes from overdense meteor trails under conditions of severe diffusion. Institute of Radio Engineers, N. Y., Proceedings, 45(9):1290-1291, Sept. 1957. 2 figs., 13 eqs. DLC--Formulas are derived and a nomogram presented for computing radar cross section of diffuse meteor trails when V = 10 to 100 km/sec, λ = 0.1 to 10 m, h = 70 to 120 km and the electron density is $<$ or $>$ Mc or the critical density. The number of ions per unit length in the column (φ) (the initial diameter (N_o) of the trail is ignored; the Lovell-Clegg scattering formula applies only when $\lambda >$ 2 m) and the diffusion coefficient (D) are also factors which are considered. (Met. Abst. 9H-31)--M. R.

B-131 Hawkins, G. S., A search for radio emission from meteors. Astrophysical Journal, 123:724-726, Nov. 1958. 2 tables, 3 refs.

B-132 Hawkins, G. S., Radio noise from meteors. Nature, London, 181(4623):1610, June 7, 1958. table, 4 refs. DLC--Kalashnikov, U. S. S. R., reported meteors to produce radio noise at about 1 c/s. Using similar equipment, the investigation of 248 meteors of visual magnitude − 1 and + 5, median value of + 2.5, gave no response within the frequency range 1 c/s − 500 Mc/s. The control experiments were conducted by Harvard College Observatory at the Mayhill Site and at the Agassiz Station, Dec. 1956 -Aug. 1957. Kalashnikov apparently misinterpreted his results. --W. N.

B-133 Hawkins, Gerald S., Electromagnetic emission from meteors. (In: Menzel, Donald H., ed., The radio noise spectrum. Cambridge, Mass., Harvard Univ. Press, 1960. p. 79-92. 4 figs., 6 tables, 7 refs.) DWB (621.38411 M551ra), DLC --This paper describes an experimental attempt to verify results obtained by Kalashnikov. A. G. Kalashnikov (1952) published an extensive account of observation of magnetic pulses which were attributed to meteors in the upper atmosphere. He presented statistical evidence which indicated a correlation between the appearance of a meteor and a corresponding deflection of the fluxmeter. Our project set up magnetometers at Sacramento Peak, New Mexico, in the vicinity of the Super-Schmidt meteor cameras of the Howard expedition to provide correlations between the magnetic records and the Price photographic data. The operation continued from April 1956 to Aug. 1957. The equipment and method of experimentation are described and specimen records are presented. The pulses detected with low sensitivity and increased sensitivity are tabulated. The parameters of the equipment are itemized. Observations at 475 Mc/s, 30 Mc/s and 218 Mc/s are noted. It is suggested that meteors do not emit radio noise that can be detected with conventional radiometers over the 30-475 Mc/s frequency range and that the radio emission in a passband of 1 Mc/s is less than 10^{-10} of the original kinetic energy. On the basis of these measurements there seems to be no possibility of a plasma oscillation occurring in the ionized column of the meteor trail. --E. Z. S.

B-134 Helbig, W. S., Storage capacity in meteor-burst communication. Institute of Radio Engineers, Proceedings, 46(9): 1649-1650, Sept. 1958. 23 eqs. --The same differential equation as Campbell derived, is involved in this independent method which includes other factors pertinent to communication problems. --W. N.

B-135 Heritage, J. L.; Weisbrod, S. and Fay, W. J., Experimental studies of meteor echoes at 200 Mc. Institute of Radio Engineers, Transactions, AP-8(1):57-61, Jan. 1960. (Also issued in "Electromagnetic wave propagation", p. 317-334. Academic Press, 1960). 11 figs., table. DLC--Experimental results of bistatic studies of meteor echoes with 200 Mc mobile equipment in Texas are discussed. Increase of burst rate with distance 940-1300 km, dropping at 1800 km. Burst rates and duty cycles were lower on than off great circle paths. Median echo duration favored Eshleman's VHF meteor echo theory, is among other findings given. --W. N.

B-136 Herlofson, N., The scattering of radio waves from meteor trails. Observatory, London, 68:230-232, Dec. 1948. Unchecked.

B-137 Herlofson, N., Plasma resonance in ionospheric irregularities. Arkiv for Fysik, Stockholm, 3(15):247-297, 1951. 14 figs., 38 refs., 92 eqs. DLC--The theory of meteor ionization is reviewed and the properties of ionized meteor trails are estimated theoretically. Theories for radio reflections from meteors are critically examined and an accurate scattering theory is formulated. The findings were that: a narrow trail with high electron density behaves as a resonator, gives strong echo waves polarized with electric vector normal to trail, if parallel, no resonance and weaker echo, due to space charge induced in the boundaries of trail as in the (Tonks and Langmuir) plasma resonance, of decisive importance for meteor echoes of wavelengths of some metres. Any irregularity can show plasma resonance. Moderate turbulance in main ionospheric layers would produce resonators. --From author's abstract.

B-138 Hey, J. S. and Stewart, G. S., Derivation of meteor stream radiants by radio reflexion methods. Nature, London, 158 (4014):481-482, Oct. 5, 1946. 3 figs., 4 refs. DLC--Brief description of a new technique using 4-5 impulse transmitters with Yagi antennas. All overhead meteors gave echoes. --W. N.

B-139 Hey, J. S., Radar observations of the Giacobinid meteors. Nature, London, 158(4016):545-546, Oct. 19, 1946. DLC--Brief editorial notes on research work by some individual workers and research centers in Britain since 1932. --W. N.

B-140 Hey, J. S.; Parsons, S. J. and Stewart, G. S., Radar observations of the Giacobinid meteor shower 1946. Royal Astronomical Society, Monthly Notices, 107(2):176-183, 1947. 7 figs., table, eq. DLC--Measured the rate and velocity of the 1946 Giacobinid meteor shower. Used 5-meter pulse radars, and found the velocities by noting the decrease in range associated with the approach of the meteors. Give a mean geocentric velocity of 22.9 km/s. A maximum rate of 300 meteors per hour was found at the peak of the shower. Plot the range distribution during the shower, and also the echo signal strength distribution. --L. A. Manning.

B-141 Hey, J. S. and Stewart, G. S., Radar observations of meteors. Physical Society of London, Proceedings, Pt. 5, 59 (335):858-883, Sept. 1, 1947. 25 figs., 5 tables, 29 refs., eqs. --Gives detailed account of investigations with vertical beam stations (1944-1946) into the cause of ionospheric echoes obtained at about 100 km height. Conclusive results for meteoric origin of the echoes obtained by using equipment with oblique beams (1945) are discussed along with a method for determination of radiants of the most active meteor streams. --W. N.

B-142 Hey, J. S., Radio reflexion from meteoric ionization. Nature, London, 160(4055):74-76, July 19, 1947. 9 refs., eqs. DLC--The recent researches as presented at the meeting of the Physical Society Jan. 31, 1947, are reported. --W. N.

B-143 Hines, C. O., Diurnal variations in the number of shower meteors detected by the forward-scattering of radio waves, Pt. 1, Theory. Canadian Journal of Physics, Ottawa, 33 (9):493-503, Sept. 1955. (For abstracts on Pt. 2 and 3, see ref. no. 101 and 150). 8 figs., table, 5 refs., eqs. DWB, DLC--Various observational factors affect the number of shower meteors which can be detected, in a given time interval, by the scattering of radio waves from the ionized meteor trails. The pertinent factors in the case of forward scattering, where the transmitter and receiver are widely separated, are expressed approximately as functions of the position of the shower radiant. In combination, they provide an observational weight factor which may change appreciably as the radiant moves in the course of a day. The consequent diurnal variation in the occurrence of scattered signals may then be determined, and distinguished from variations due to random changes in the incidence rate of the meteors. (Met. Abst. 7.5-67)--Author's abstract.

B-144 Hines, C. O., Diurnal variations in forward-scattered meteor signals. Journal of Atmospheric and Terrestrial Physics, 9(4):229-232, Oct. 1956. 3 figs., 7 refs. DWB--Predictions are made of diurnal variations of random meteor counts at Ottawa, over paths of about 1000 km, for various circuits over Canada. (Met. Abst. 8.2-293)--C.E.P.B.

B-145 Hines, C. O. and Pugh, R. E., Spatial distribution of signal sources in meteoric forward-scattering. Canadian Journal of Physics, Ottawa, 34(10):1005-1015, Oct. 1956. 3 figs., 7 refs., 20 eqs. DWB, DLC--The spatial distribution of observable meteor trails is determined with the aid of the 'cylindrical approximation' appropriate to forward-scattering observations. Contour charts of the distribution are presented, and found to compare favorably with those obtained from a more exact analysis, presented in a companion paper. Typical effects of the signal durations are also examined. The whole is compared with an earlier development by ESHLEMAN and MANNING (1954), which treats closely related aspects of meteoric forward scattering. (Met. Abst. 8.4-340)--Authors' abstract.

B-146 Hines, C. O. and Forsyth, P. A., The forward-scattering of radio waves from overdense meteor trails. Canadian Journal of Physics, Ottawa, 35(9):1033-1041, Sept. 1957. 22 refs., 19 eqs. DWB, DLC--The forward-scattering of radio waves from overdense meteor trails is treated from an elementary point of view. The results indicate that the same geometric factors enter this problem as enter the problem of forward-scattering from underdense trails, and that the transition between underdense and overdense trails occurs at the same value of charge density as in the backscatter case. These conclusions are not expected to be generally valid when applied to individual trails, but at least they should provide a valid basis for the interpretation and prediction of the effects produced statistically by a large number of trails. (Met. Abst. 9. 7-264)--Authors' abstract.

B-147 Hines, C. O. and O'Grady, M., Height-gain in the forward scattering of radio waves by meteor trails. Canadian Journal of Physics, 35(1):125-127, Jan. 1957. fig., 4 refs., eq. DLC--Computational results of the effect of variation angle and meteoric height are summarized and discussed. Variation in antenna illumination is reflected in the curve forms. --W. N.

B-148 Hines, C. O. and Vogan, E. L., Variations in the intrinsic strength of the 1956 Quadrantid meteor shower. Canadian Journal of Physics, Ottawa, 35(6):703-711, June 1957. 6 figs., 12 refs. DWB, DLC--The occurrence rate of meteoric signals, detected on a VHF forward-scatter path, is analyzed for the time of the 1956 Quadrantid shower. The detection rate of the shower meteors is converted to an incidence rate, by use of the appropriate forward-scatter theory. The variation in the intrinsic strength of the shower is thereby determined, on an hour-to-hour basis, and it is compared with variations which have been obtained in other years by other methods. The comparison reveals a distinct secular shifting of the orbit of the Quadrantid meteor stream. It also illustrates the marked advantage of the new technique in assessing variations in the strengths of short lived showers. (Met. Abst. 8H-110)--Authors' abstract.

B-149 Hines, C. O., A theoretical rate-amplitude relation in meteoric forward scatter. Canadian Journal of Physics, 36(5): 539-554, May 1958. 5 figs., table, 12 refs., 40 eqs. DLC --The theory of the forward-scattering of radio waves by ionized meteor trails is applied to the development of a rate amplitude relation. This relation expresses the anticipated occurrence rate of scattered signals which exceed a chosen amplitude level, as a function of that level. It is compared with preliminary observational data, and found to be in good agreement both qualitatively and quantitatively. Closest agreement is obtained only with an appropriate choice of two scaling factors. These provide an abstract of the observations in a form which is convenient for further study and interpretation. --Author's abstract.

B-150 Hines, C. O., Diurnal variations in the number of shower meteors detected by the forward-scattering of radio waves, Pt. 3, Ellipsoidal theory. Canadian Journal of Physics, Ottawa, 36(1):117-126, Jan. 1958. (For abstracts on Pts. 1 and 2, see ref. no. 143 and 101). 5 figs., 9 refs., 12 eqs. DWB, DLC--A theory of meteor 'observability' relating to forward-scatter radio experiments was developed in Pt. 1 of this series, with the use of a simplifying 'cylindrical approximation'. The application of the theory to data obtained during meteor showers provides a promising new method for studying the intrinsic strengths of the showers. The principal limitation of the method is due to the inaccuracies of the cylindrical approximation. In the present paper, these inaccuracies are removed by a full development of the ellipsoidal geometry inherent in the forward-scatter process. The more rigorous results are compared with the approximate results at various stages throughout the analysis. (Met. Abst. 9.7-263)--Author's abstract.

B-151 Hines, C. O. (Defence Res. Board, Ottawa, Canada), An interpretation of certain ionospheric motions in terms of atmospheric waves. Journal of Geophysical Research, Wash., D. C., 64(12):2210-2211, Dec. 1959. 5 refs., 2 eqs. DLC--Internal atmospheric waves, subject to gravitational and compressional forces, have characteristics in close accord with measurements of ionospheric motions revealed by meteor trails. They are also consistent with other types of observational evidence on movement in the ionosphere. Many of the observations may therefore find their proper interpretation in terms of these waves. --Author's abstract.

B-152 Hines, C. O. (Radio Physics Lab., Defence Res. Board, Ottawa, Canada), Turbulence at meteor heights. Journal of Geophysical Research, Wash., D. C., 64(8):939-940, Aug. 1959. 6 refs. DLC--A preliminary outline of a new approach to the study of motions at meteor heights is given, the fundamental assumption being that these motions are perturbation velocities associated with propagating atmospheric waves. Several observed features of the large-scale motions are thereby explained, and a basis is laid for the study of associated smaller-scale "turbulent" motions. It is found that smaller scale motions having appreciable amplitude need not be anticipated a priori, contrary to an earlier conclusion derived from conventional turbulence theory. (Met. Abst. 11. 10-108)--Author's abstract.

B-153 Hoffleit, Ellen Dorit, Bibliography on meteoritic dust with brief abstracts, including compilation by the late Willard J. Fisher. Harvard Univ. Harvard College Observatory, Contract NOrd 10449, Task I and Contract N5ori-07647, Technical Report, No. 9, 1952. 45 p. 505 refs. Also issued as its Harvard Reprints, v. 2, No. 43, DWB--This annotated bibliography contains 505 references to articles on meteoric dust in its historical, observational, theoretical and instrumental aspects (including some related material on auroras, noctilucent clouds, etc.) all arranged alphabetically by senior author. The basis of the bibliography was a card catalog of 125 abstracts on meteoric dust prepared by WILLARD J. FISHER before his death in 1934. This material was extended by searching a number of standard journals or bibliographic sources, mostly astronomical. Not all of the items were checked against the original. (Met. Abst. 6B-121)--M. R.

B-154 Hoffmeister, C., Die Strömungen der Atmosphäre in 120 km Höhe. (Atmospheric currents at a height of 120 km.) Zeitschrift für Meteorologie, 1(2/3):33-41, Nov./Dec., 1946. 8 figs., 2 tables, 5 refs. DWB--Observations of meteor trails were partly visual, partly photographic. Height determinations from pairs of photographs showed optimum density for trails to be about 120 km and this height was assumed throughout. Results of observations of velocity and direction shown graphically. There is ample photographic evidence of strong turbulence at this level. (Met. Abst. 4F-32)--G. J. E.

B-155 Hoppe, J., Das internationale Geophysikalische Jahr, V, Neues von den Meteoren. (The IGY: Pt. 5, New facts about meteors.) Umschau, 57(9):263-265, May 1, 1957. 3 figs., 13 refs. DLC--A general description of meteors is given, including source of light and ionization channel which reflects radar. Most of the energy goes into ionization and becomes free on recombination, accounting for part of visible trail. "Fireballs" are compared with meteorites. The part played by radar in meteor investigation is emphasized, including determinations of air density and wind. (Met. Abst. 8. 8-37)--C. E. P. B.

B-156 Isted, G. A., Meteor activity as a factor in ionospheric scatter propagation. Marconi Review, London, 21(131):161-172, 1958. 9 figs., 18 refs. DLC--The author suggests that weather cloud discharges may be capable of producing bursts of ionization similar to those produced by meteors. Evidence has been found of groups of bursts having regular spacing between bursts; furthermore some of these groups are associated with thundercloud discharges in a manner which cannot be ignored. Interesting evidence has come to light which shows that the seasonal variation of relatively local lightning activity has clearly defined minima at each of the equinoxes despite the fact that the meteor theory would predict maximum ionization at the autumnal equinox. Meteor activity may be found to play a relatively small part in ionospheric forward scatter propagation and it is possible that the weather-cloud discharge of some other mechanism, as yet unidentified, may instead prove to be the dominant factor. (Met. Abst. 11E-69)--From author's abstract.

B-157 Isted, G. A., Round-the-World echoes. (In: International Union of Pure and Applied Physics, Solid state physics in electronics and telecommunications: Proceedings of a conference, Brussels, 1958. pub. London, Academic Press, 1960. p. 515-526). Unchecked.

B-158 Jacchia, Luigi G. and Wright, Frances W. (trans.) (Harvard Coll. Obs.), Russian research on meteors and meteorites carried out in U.S.S.R. for the two years, Oct. 1950-Oct. 1952 (not including Czechoslovakia, Poland, etc.). 1953. 2 p. Mimeo.--Notes on texts and other works on meteors published in U.S.S.R. recently and circulation of each of 8 works (12,000 to 60,000 copies). Conferences are also mentioned. (Met. Abst. 8H-29)--M. R.

B-159 Jouaust, R., Radio électricité et météorites. (Radio electricity and meteorites.) L'Onde Electrique, 28(253):150-157, 1948.--Summarizes general facts about meteors. Discusses mechanism of ionization production, diffusion; points out earth's magnetic field not strong enough to influence diffusion. Describes radio reflections from meteors, including Doppler meteor whistles; relation of meteors to sporadic-E ionization. Reviews investigations on meteors of other workers. A general survey.--L. A. Manning.

B-160 Kahlke, S., Meteorschweife und hochatmosphärische Windströmungen. (Meteor trails and wind currents in the high atmosphere.) Annalen der Hydrographie und Maritimen Meteorologie, 49(9):294-299, Sept. 1921. DWB--

Author discusses meteor trails in Northern Hemisphere. Daytime and night-time observations of meteor dust listed separately and direction of drift given for each. Earliest observation quoted is for 1741. (Met. Abst. 4F-5)--G. J. E.

B-161 Kaiser, T. R. and Closs, R. L. (Univ. of Manchester), Theory of radio reflections from meteor trails. Philosophical Magazine, London, 43(336):1-32, Jan. 1952. 16 figs., table, 92 eqs. DWB--Discusses the evaluation of the reflection coefficient for backward scattering of an electromagnetic wave from a cylindrical column of ionization and its application to echoes from meteors passing through the atmosphere. Two cases are distinguished: depending on whether the electron line density is less or greater than 10^{12}/cm. In the former, if the electric vector is parallel to the trail, the echo decreases exponentially; if normal to the trail resonance effects occur. With greater electron density the column reflects like a metal cylinder. (Met. Abst. 4.1-255)--C. E. P. B.

B-162 Kaiser, T. R. and Greenhow, J. S., On the decay of radio echoes from meteor trails. Physical Society of London, Proceedings, Ser. B, 66(2):150-151, Feb. 1, 1953. 5 refs. DWB--The hypothesis of J. FEINSTEIN that long duration echoes from meteor trails are due to initial shock-wave expansion of the trail is rejected in favor of the authors' diffusion theory, and fluctuations are attributed to trail distortion by upper winds. (Met. Abst. 4.8-262)--C. E. P. B.

B-163 Kaiser, T. R. (Univ. of Manchester), Radio echo studies of meteor ionization. Advances in Physics, London, 2(8): 495-544, Oct. 1953. 25 figs., refs. p. 543-544, eqs. DLC --In this comprehensive review article numerous aspects of the quantitative investigation of the physical properties of the upper atmosphere by 4 to 10 m radio reflections from meteors and meteor trails are discussed theoretically and empirically, and the results of a large amount of original investigation made at Jodrell Bank, England, and never before published, incorporated therein. The theory of meteor ionization and dissipation of these ions; the theory of scattering of radio waves from meteor trails and experimental data on this subject; the estimation of ionospheric winds from fading of echoes; recombination and attachment in meteor trails; correlation with visual meteors; theory of meteor height distribution and properties of the upper atmosphere as determined from the meteor flight distribution; determination of constants used in meteor ionization equations, theory of radio echo rate, mass distribution of incident meteors; radio echo rate as function of equipment parameters;

distribution of radio echo durations, total incident flux and space density of meteors and total ionization produced by meteors constitute the subject matter of the various chapters. Numerous graphs and curves show the actual and theoretical relationships involved in all of these phases of meteor research. Comparisons are made with rocket and meteor data obtained in the U. S. and Australia. It is concluded that the incident flux of sporadic meteors is sufficient to maintain a continuous ionospheric layer from 130 down to 115 km below which ionization will be distributed in patches becoming fewer with decreasing height. (Met. Abst. 5.5-6) --M. R.

B-164 Kaiser, T. R. (Jodrell Bank Experimental Station, Univ. of Manchester), A new technique in upper atmosphere research. (In: Boyd, R.L.F.; Seaton, M. J. and Massey, H.S.W. (eds.), Rocket exploration of the upper atmosphere. London, Pergamon, 1954. p. 108-111. 2 figs., 12 refs., 2 eqs.) DWB--Values of atmospheric pressure, scale height, and wind velocity as a function of height (within a somewhat restricted range about 90 km) may be deduced from radio echo measurements of meteor heights and range drifts. (Met. Abst. 8H-104)--Author's abstract.

B-165 Kaiser, T. R., A symposium on meteor physics at Jodrell Bank. Observatory, London, 74(882):195-208, Oct. 1954. photo. DWB--Summary of sessions on July 20-22, 1954. Under "General problems in meteor physics" Dr. THOMAS reviewed knowledge of heat transfer and ablation, A. F. COOK spoke on "The nature of meteoric radiation", E. ÖPIK contributed a paper on "Meteor ionization and excitation" and he and others discussed masses of meteors. Under "Radio echo investigations: ionization and excitation" a number of contributions were discussed. Under "Meteors and the upper atmosphere", scale height determinations, densities, velocity, upper winds, turbulence and ionospheric effects were discussed. Other sessions dealt with "Astronomical problems of matters","Meteors and International Geophysical Year". (Met. Abst. 6.6-255)--C.E.P.B.

B-166 Kaiser, T. R., Theory of the meteor height distribution obtained from radio-echo observations, pt. 1-2. Royal Astronomical Society, Monthly Notices, 114(1):39-62, 1954. 12 figs., 15 refs., 6 eqs. DWB--The radio-echo height distribution for a homogeneous meteor stream is shown to be a function only of the atmospheric scale height and the mass distribution of the meteors. The results enable the observed dependence of the mean height on the velocity to be interpreted in terms of the variation of atmospheric pressure with height. (Met. Abst. 6.6-238)--C.E.P.B.

B-167 Kaiser, T. R. (Univ. of Manchester, Jodrell Bank Experimental Station), The incident flux of meteors and the total meteoric ionization. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 119-130. 4 figs., 4 refs., 48 eqs.) DWB--Theoretical formulas are derived which relate the rate of meteors observed on a radio-echo equipment to the incident meteor flux. In addition, the mean rate of production of ions (in $cm^{-3} sec^{-1}$) at any height is evaluated as a function of the incident flux. Experimental results are given for sporadic meteors and for several of the major meteor showers. The meteoric contribution to the ionospheric E region is discussed. (Met. Abst. 8.1-361)--Author's abstract.

B-168 Kaiser, T. R. (Univ. of Manchester, Jodrell Bank Experimental Station), The interpretation of radio echoes from meteor trails. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 55-64. 7 figs., 14 refs., 21 eqs.) DWB--The theory of the reflection of radio waves from meteor trails is summarized. Particular attention is given to the case of a meteor moving in an atmosphere with a constant wind-shear. The effects of diffusion, attachment, and recombination are considered, and it is shown that the decay of ionization due to recombination is in general much less rapid than the decay in the train luminosity produced by recombination. Some recent observations of visual magnitude vs. echo duration are given. A definition is proposed for a scale of "Radio Magnitude" related to the electron line density, so that a meteor of radio magnitude 5^m produces a maximum electron line density of $10^{12} cm^{-1}$. (Met. Abst. 8H-111)--Author's abstract.

B-169 Kaiser, T. R. (ed.), Meteors. Special supplement (Vol. 2) to the Journal of Atmospheric and Terrestrial Physics, London, Pergamon Press, 1955. 204 p. numerous bibliogs. and illus. DWB--A collection of 39 papers which were read at the Symposium on Meteor Physics held at Jodrell Bank Experimental Station in July 1954 on invitation of A. C. B. LOVELL are printed in permanent book form. Each paper was abstracted separately and the contents were listed in Pt. III, p. 927, July 1956, Met. Abst. The subjects treated include meteor ablation, luminosity, ionization, spectra, collision processes, radio echoes, masses, space density drift, zodiacal dust cloud, orbits as determined photographically or by radio, effects on ionosphere and upper air data obtained from meteors (pressure, winds, scale height). (Met. Abst. 8H-61)--M. R.

B-170 Kaiser, T. R. and Evans, S. (both, Jodrell Bank Exp. Station, Manchester Univ.), Upper atmospheric data from meteors. Annales de Geophysique, Paris, 11(2):148-152, April/June 1955. 3 figs., 19 refs. DLC--Photographic and radio echo soundings of meteors are analyzed to give data on scale-height, density and wind in the high atmosphere. Work on these lines in the past 10 years is summarized and some quantitative results given in graphic form (scale height 85-110 km, density 85-105 km, and diurnal and seasonal variations in mean height for a given meteor velocity from radio echoes). Latter data do not support large seasonal and latitude variations in atmosphere density. The photographic method is better for studies of detailed structure of atmosphere at high elevation and the radio echo method for continuous measurements of means. (Met. Abst. 8H-62)--M. R.

B-171 Kaiser, T. R., The determination of the incident flux of radio meteors. Royal Astronomical Society, London, Monthly Notices, 121(3):284-298, Sept. 1960. 12 figs., 15 refs., 35 eqs. DLC--The observed rate of radio meteors depends on a number of factors which include: (i) the incident flux and distribution in magnitude of the meteors; (ii) the radiant coordinates; (iii) the variation in ionization along a meteor trail; (iv) the nature of the radio reflection process; and (v) the parameters of the radio echo equipment. The present work represents a considerable simplification over previous attempts to relate the radio echo rate to the actual flux of meteoroids. Simple formulae are derived relating these two quantities which, when used together with suitable graphical representation of the directional properties of the aerial system and of the reflection geometry, enable the incident flux of shower meteors to be deduced from the observed rate. The fact that the variation with time of the shower rate obtained with a fixed aerial beam may be predicted is relevant in connection with a method for shower radiant determination. Limitations due to the approximations in the theory, and to the simplified ablation theory on which it is based, are discussed.--Author's abstract.

B-172 Keary, T. J. and Wirth, H. J. (both, U. S. Navy Electronics Lab., San Diego, Calif.), The random occurrence of meteors in the upper atmosphere. Journal of Geophysical Research, Wash., D. C., 63(1):67-75, March 1958. 6 figs., table, 5 refs., 7 eqs. DLC--This paper reports an experimental study of the distribution of time intervals between bursts of 43.5 Mc/s signals received over a 690 km path from Stanford, Calif., to San Diego, Calif., with object of determining whether or not the bursts occurred completely at random. The distribution of time intervals observed is consistent with the distribution expected if the bursts are produced by scattered radiation from the ionized trails of meteors which enter the upper atmosphere at random. The number of time intervals observed less than one second is appreciably less than the number calculated. This would be the case if some bursts were not observed when the interval between bursts is comparable to the duration of the bursts. The difference between observed and calculated values for large intervals for which the actual number of observations is small is not statistically significant. The observed number of triplets of equally spaced bursts substantially agrees with the number expected if the bursts occurred at random. The data used in this analysis were the intervals preceding 778 bursts observed during 0400-0600 h on Aug. 3, 1956 and those preceding 446 bursts observed during 0500-0700 h on Nov. 6, 1956. (Met. Abst. 9. 11-291)--Authors' abstract.

B-173 Keary, T. J. (Navy Electronics Lab., San Diego), International Conference on Radio Wave Propagation. Institute of Radio Engineers, N. Y., Proceedings, 47(6):1147-1148, June 1959. DWB--Brief reviews of 15 or so of the 55 papers read by the 100 radio scientists from 12 countries who attended the Congres International sur la Propagation des Ondes Radio Electriques, Oct. 6-11, 1958, at the Palais des Congres at Liege, Belgium. Papers dealt with summaries of progress on work over the past few years in the following areas (under which the abstracts are arranged): (1) Beyond-the-horizon propagation of UHF waves; (2) Ionospheric back-scattering research; (3) Forward scattering from ionized meteor trails; (4) Low frequency propagation. The complete text will be published by Academic Press. (Met. Abst. 11. 7-37)--M. R.

B-174 Keary, T. J., and H. J. Wirth, Statistical characteristics of forward scattered radio echoes from meteor trails. (In: International Union of Pure and Applied Physics, Solid state physics in electronics and telecommunications: Proceedings of a conference, Brussels, 1958. pub. London, Academic Press, 1960. p. 277-290).

B-175 Keay, C. S. L., Meteor radiant determination from high echo-rate observations. Australian Journal of Physics, 10 (4):471-482, Dec. 1957. 8 figs., 2 tables, 6 eqs. DLC--A simplified analysis is given of the Clegg method for delineating meteor radiants from radar observations. A further analysis reveals a new and faster method of interpreting the data contained in meteor echo records. This method is applicable when sensitive equipment is employed and the resulting echo rate is very high. --Author's abstract.

B-176 Keitel, Glenn H., Mode solutions for radio waves scattered by meteor trails. Stanford Univ. Radio Propagation Laboratory, Contract AF 19(604)-1031, Scientific Report, No. 1, April 30, 1955. 104 p. 28 figs., 3+tables, 29 refs, 93 eqs. DWB. Condensed version as Certain mode solutions of forward scattering by meteor trails. Institute of Radio Engineers, N. Y., Proceedings, 43(10):1481-1487, Oct. 1955. 11 figs., 14 foot-refs., eqs. DLC--A model assuming a Gaussian distribution of ionization (diffusion from a line) which would apply to any cylindrically symmetrical ionization column, is used in this study. The wave matching treatment is used to evolve theory for normal and oblique incidence. A high speed digital computer (SWAC) was used to obtain values of linear ion density, column size, and collisional losses for incident wave using 3 different matching radii. Reflection coefficients for a low density column $q = 10^{13}$ electrons/m are compared by results obtained by electron scatter analysis for a parallel polarized incident wave and a transverse polarized incident wave. Echo duration, effect of collision losses, fields within column and details of integration program are treated in separate sections. (Met. Abst. 8H-112)--M. R.

B-177 Knight, Thomas G., Applicability of multipath protection to meteor burst communications. Institute of Radio Engineers, Transactions, CS-7(3):209-210, Sept. 1959. fig., table, ref. DLC--Countermeasures against three main sources of multipath are discussed along with improved systems, including the RAKE system, exploiting wind shear effects. --W. N.

B-178 Landmark, B., The fading of long-duration meteor bursts in forward scatter propagation. Journal of Atmospheric and Terrestrial Physics, 12(4):341-342, July 1958. fig., ref. DLC--Premise of this study was to demonstrate the applicability of Manning's method to investigate the wind shear in the lower E layer. The results are presented in curves for July and Oct. 1957 featuring the cross correlation between observed signal envelopes in two points with variable spacing and the mean value of the correlation coefficient determined for each fading cycle number z plotted as a function of ξz. The point of different values of ξ followed the same curve, the shape of which was approximately Gaussian in agreement with Manning's findings. The wavelength used was 6.4 m and values of ξ between 4 and 10. --W. N.

B-179 Lindblad, B., A radar investigation of the Delta-Aquarid meteor shower of 1950. Göteborg, Sweden. Chalmers Tekniska Högskola, Handlingar, Transactions, (129):1-26, 1952. --Analytical results of radar observations at 33 Mc/s conducted at the Onsala Wave Propagation Observatory during July 25-Aug. 1950, are discussed. The percentage curve of long durated echoes is representative for the visual meteor activity. Several characteristics of the Aquarid radiant are exposed, whose center of radiation is placed at 340° - 14°. Sorting of shower particles relative to size is indicated. --W. N.

B-180 Lindblad, Bertil-Anders, Combined visual and radar observations of Perseid meteors. I: Observations in 1953. Göteborg, Sweden, Chalmers Tekniska Högskola, Research Laboratory of Electronics, Report. Unchecked.

B-181 Link, F. (Astronomical Inst., Czechoslovak Academy of Sciences, Prague), Contribution of meteoritic material to the atmospheric absorption. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 79-80. 15 refs., eqs.) DWB--Optical measurements of atmospheric absorption, great meteor showers, time of fall measured by clearing at the zenith after and dates of heavy rains 30 days after shower activity (BOWEN), oceanographic soundings, zodiacal light and direct collection of meteoric dust give various values of size distribution; those most recently obtained showing same order of magnitude agreement. (Met. Abst. 8H-65)--M. R.

B-182 Little, C. G.; Rayton, W. M. and Roof, R. G., Review of ionospheric effects at VHF and UHF. Institute of Radio Engineers, N. Y., Proceedings, 44(8):992-1018, Aug. 1956. 2 tables, 182 refs., 3 + eqs. DLC--This paper summarizes the present-day knowledge of ionospheric effects at VHF and UHF, with the exception of forward scattering of VHF radio waves by the ionosphere. The seven effects covered in the paper are: Radar echoes from aurora, Radar echoes from meteors, The Faraday effect and Radar echoes from the moon, Radio noise of auroral origin, Absorption of radio waves by the ionosphere, Refraction of radio waves by the ionosphere, and the Scintillation of the radio stars. Each ionospheric effect has in turn been divided into separate subtopics, and the main results are given in these subsections, with particular emphasis upon providing references to the original papers. In this way the reader wishing to know the answer to a specific problem will speedily be able to find a summary of the main published results in the field, and also be able to learn which papers deal with the particular topic of interest. (Met. Abst. 8H-81)--Authors' abstract.

B-183 Lowenthal, M., On meteor echoes from under dense trails at very high frequencies. Lincoln Laboratory, Technical Report, No. 132:69, AD 137-608, 1956. Unchecked.

B-184 Lovell, A. C. Bernard, Electron density in meteor trails. Nature, London, 160(4072):670-671, Nov. 15, 1947. -- Gives the "Lovell-Clegg" scattering formula for meteoric-echo amplitude. Gives results of a multifrequency amplitude measurement which verified that received power varied as the third power of the wavelength. Frequencies of 36, 46, and 72 Mc/s were used. Claims that a fifth magnitude meteor produces about 2×10^{10} electrons per centimeter of path. (This result is now known to be wrong by a factor of about a hundred. (See ref. no. 111). -- L. A. Manning.

B-185 Lovell, A. C. B., Meteoric ionization and ionospheric abnormalities. Physical Society of London, Report on Progress in Physics, 11:415-444, 1946/1947. Unchecked.

B-186 Lovell, A. C. B., Meteors, comets and meteoric ionization. Nature, London, 160(4055):74-78, July 19, 1947. 16 refs. DLC--Under the headings of: Meteors, Comets and their relationship with meteors, ionization due to meteors in the atmosphere, and theory of meteor ionization. Several papers presented at the conference, March 19 and 20, 1947 in Manchester Univ., Physical Laboratories are reported briefly. --W. N.

B-187 Lovell, A. C. B.; Banwell, C. J. and Clegg, J. A., Radio echo observations of the Giacobinid meteors 1946. Royal Astronomical Society, Monthly Notices, 107(2):164-175, 1947. 9 figs., 4 tables, 2 refs., eq. DLC--Observed the 1946 Giacobinid meteor shower on 4. 2 meters wavelength using a narrow beam antenna. During the peak of the shower, an echo rate of 168 per minute was obtained, contrasted with a pre-shower norm of about two per hour. They computed the line density of electrons corresponding to the meteor echoes with the aid of the Lovell-Clegg formula, but it is now known that for the large visual meteors involved, that formula is inapplicable; the agreement claimed with Herlofson's theoretical calculations can only be considered fortuitous, as the densities must be in error by a large factor. The distribution in size of the particles was also computed, but inasmuch as this calculation was again based upon the Lovell-Clegg relation, the results are incorrect. The perpendicular reflection condition was verified by directing the aerial beam away from the normal to the radiant; the observed rate dropped to 4 percent. Examples

of the fading of the long duration echoes are presented, the height distribution of the echoes is shown, and a table presents the number of echoes in several duration ranges before, during, and after the peak of the shower. --L. A. Manning.

B-188 Lovell, A. C. B. and Clegg, J. A., Characteristics of radio echoes from meteor trails, Pt. I, The intensity of the radio reflections and electron density in the trails. Physical Society of London, Proceedings, 60:491-498, May 1948. (For abstracts on Pts. 2, 3, and 4 see ref. no. 21, 110, and 13). --Formulas are derived for the intensity of the radio wave scattered from a meteor trail on the assumption that the electrons are created in a long narrow column, of small diameter compared with the wavelength of the radio wave. Experimental work is described which shows that the predicted variation of received power with wavelength is correct for the wavelength range 4.2 m to 8.3 m, and according to preliminary results down to 1.4 m. The formulas can then be used to measure the electron density in the trails of meteors. Of particular interest are the measurements for meteors which are also observed visually. The results show that the density in the trail of a 5th-magnitude meteor (on the limit of naked eye visibility) is approximately 2 X 10^{10} electrons/cm path. Brighter meteors (∞ magnitude + 1) produce 10^{12} electrons/cm path. These results are in good agreement with theoretical calculations. The theory is compared with earlier calculations. (Met. Abst. 8H-10)--Physics Abstracts.

B-189 Lovell, A. C. B., Combined radar, photographic and visual observation of the Perseid meteor stream of 1947. Nature, London, 161(4086):278-280, Feb. 21, 1948. fig., 2 tables, 6 refs. --Brief report on observations conducted Aug. 9-14. The main equipment was located at the National Research Council, four miles south of Ottawa, and a secondary visual and photographic at Luskville, 22 miles distant. Tabulated data show echo duration from 17-63 sec and ranging from 126-171 km. Echoes lasting < 5 sec were 12 times as frequent as the long durated ones, and 54 first magnitude and brighter meteors gave no echoes. --W. N.

B-190 Lovell, A. C. B., Meteors and their effect on radio. Institute of Electrical Engineers, Journal 95, pt. 3, No. 37: 324, Sept. 1948. 9 refs. --Brief discussion in terms of scattering as a function of λ , echo observation, duration and intensity, diffraction effects and sporadic E ionization. --W. N.

B-191 Lovell, A. C. B. and Prentice, J. P. M., Radio echo and visual observations of the Bielid meteor streams 1946-47. British Astronomical Association, Journal, 58(4):140, May 1948. 4 tables. --Brief account showing no significant return in the streams as would be likely if, as suggested, they were connected with Biela's comet. --W. N.

B-192 Lovell, A. C. B., Meteor ionization in the upper atmosphere. Science Progress, 38(419):22-42, 1950. 10 figs., table, 32 refs. --The present state of knowledge and some problems yet in the matrix are surveyed. --W. N.

B-193 Lovell, A. C. B. and Davies, J. G., Radar tracks shooting stars. Radio Electronics, 22, July 1951. --"Modified radar methods of determining the number, distance, direction, and speed of meteors are valuable in studying conditions in the high stratosphere, such as wind motion and ionization. The apparatus used at Jodrell Bank is described. Method of calculation of meteor velocity is explained and graphically illustrated by photos of oscilloscope patterns."

B-194 Lovell, A. C. Bernard, Meteor astronomy. Oxford, Clarendon Press, 1954. 463 p. 186 figs., 175 tables, numerous foot-refs., numerous eqs. International Series of Monographs on Physics, ed. by N. F. Mott and E. C. Bullard. DLC--This book deals mainly with the astronomical aspects of meteors as distinguished from meteorites, or micro-meteorites. Meteors and the zodiacal light, Doppler methods (fast and slow Doppler) of observation by radio, effect on E region, electron density in E region; evaporation, speed, direction, height, drift, etc., are treated among other subjects. The physics of meteors is not considered. (Met. Abst. 7.3-18) --M. R.

B-195 Lovell, A. C. B. (Jodrell Bank Experimental Station), Meteors and the International Geophysical Year. (In: Kaiser, T. R. ed., Meteors. London, Pergamon Press, 1955. p. 184-187. 10 refs.) DWB--A brief history of the IGY and 2 Polar Years is followed by a discussion of meteors and world days, and meteors and the ionosphere to show how meteor observations fit in with the program for world days and for the ionosphere, respectively. World days are specified for 2 days each month at new moon and one near quarter moon to coincide with major meteor showers. Four additional days with unusual meteoritic activity (June 30, July 30, Aug. 12 and Dec. 14, 1958) are added. Drifts in E region can be determined by following ionized meteor trails at Jodrell Bank. Also scale heights and densities in the 50-100 km region will be obtainable by use of the Super-Schmidt meteor camera. (Met. Abst. 8.7-33)--M. R.

B-196 Lovell, A. C. B., Radio astronomy and the fringe of the atmosphere. Royal Meteorological Society, Quarterly Journal, 82(351):1-14, Jan. 1956. 13 figs., 54 refs. DWB--This Symons Memorial Lecture summarizes 6 branches of radio astronomy. Scintillation of radio stars is due to elongated ionized clouds in the F region about 400 km moving with an average speed of 100 m/s in 50-60°N to 360 m/s in the auroral zone. The apparent predominance of E-W and W-E motion may be due to the shape of the clouds. Drifts of radar reflections from ionized meteor trails at 70-120 km have given much information about semidiurnal and annual variation of winds. Scale heights, pressures and diffusion coefficients in the 100 km region can also be determined by radio-echo meteor techniques. Sec. 6 describes the investigation of auroras by radio echoes, including determination of drift velocities (which are probably not due to winds). Finally, the bearing of moon echoes on the total electron content of the ionosphere is mentioned. (Met. Abst. 7.6-74)--C.E.P.B.

B-197 Lovell, A. C. B., Geophysical aspects of meteors. Handbuch der Physik, Berlin, 48:427-454, 1957. 22 figs., 4 tables, 60 foot-refs., 10 eqs. DWB (551.03 N236)--The evaporation of a meteor, methods and instruments for measuring the radiation and ionization, diurnal and seasonal variations in meteor influx, mass distribution, height range and frequency, scale height and density determinations, wind observations at very high levels by means of meteors (photographic and radio), recombination and diffusion of the ionized column, and effect of total meteor influx on ionospheric ionization are treated systematically and quantitatively, with many fine illustrations of both records and completed results. (Met. Abst. 8H-95)--M.R.

B-198 Lovell, A. C. B. (Jodrell Bank Exp. Sta., Univ. Manchester), Meteors. (In: Bates, D. R., (ed.), The earth and its atmosphere. N. Y., Basic Books, 1957. p. 256-272. 5 figs., 2 tables.) DLC--Shooting stars, visual and photographic methods of meteor investigation, radio methods, origin of meteors, shower meteors, sporadic meteors, evaporation of meteors, methods of measuring physical properties of the upper atmosphere by meteor study, numbers and masses of meteors, meteorites and their composition, large meteors and craters, origin of meteorites, micrometeorites and the zodiacal light are discussed for popular consumption, with several good schematic diagrams. (Met. Abst. 9.11-292)--M.R.

B-199 McKinley, D. W. R. and Millman, P. M., A phenomenological theory of radar echoes from meteors. Institute of Radio Engineers, Proceedings, 37:364-375, April 1949. DLC--Combined visual, photographic and radar observations are summarized and general conclusions drawn. The radar echoes are classified into basic types according to their appearances on a range-time display. These types include echoes indicating approach, or recession, or both. Other observed features are: durations up to several min, complex structure for brighter meteors, and delays in the appearance of echoes. A phenomenological theory is proposed, involving a number of postulates concerning an M region in the upper atmosphere. Kinetic energy and u. v. mechanisms are suggested to account for the ionization produced. In the M region are visualized striae, or patches, which form a fine structure such that within them the physical properties of the atmosphere emphasize the creation and maintenance of meteor ionization. A qualitative explanation of all the observed echo forms is advanced on this hypothesis, and results on other wave lengths are consistent with it. (Met. Abst. 8H-12)--Physics Abstracts.

B-200 McKinley, D. W. R. and Millman, P. M., Determination of the elements of meteor paths from radar observations. Canadian Journal of Research, 27(3):53-67, 1949. 5 figs., 3 tables, 22 refs., 9 eqs. DLC--The results of a three-station triangulation around the clock for two weeks in Aug. 1948, are discussed. The 30-36 Mc radar equipments were installed at Ottawa, Arnprior and at Carleton Place. Determinations of meteor velocities from single and from three-stations observations are computed, involving the following four methods: 1) curve fitting; 2) R R; 3) three point; and 4) the parabolic method. Determination of the orbit of a meteor is explained by an example. --W. N.

B-201 McKinley, D. W. R., Deceleration and ionizing efficiency of radar meteors. Journal of Applied Physics, 22(2):202-213, Feb. 1951. --Explains method of analysis of radar and Doppler records for meteor velocities and decelerations. Discusses in detail three meteors for which deceleration could be found from the range-time display. The velocities of these meteors were 21.5, 49.0, and 61.0 km/s as measured at the start of path; the decelerations were found as 0.48, 1.1, and 1.5 km/s^2. Gives examples of meteor whistles with beat-like amplitude fluctuations. Computes ionizing efficiency for these meteors using Lovell's formula for the reflected signal strength. However, since Lovell's formula is known to be inapplicable to large visual meteors such as were observed, these results should be discounted. --L. A. Manning.

B-202 McKinley, D. W. R., Meteor velocities determined by radio observations. Astrophysical Journal, 113(2):225-267, March 1951. 13 figs., 19 tables, 18 refs., 18 eqs. DLC--The meteor-echo theory is reviewed and then extended to computation of meteor velocities from the amplitude-time records of the echoes. Analysis of 10,933 meteors during Dec. 1948-March 1950 is given. Included also is a simplified theoretical analysis of meteor orbit and radiant problems which suggests meteoric movement in elliptical orbits, more direct than retrograde motions. --W. N.

B-203 McKinley, D. W. R. (Ottawa, Canada), Variation of meteor echo rates with radar system parameters. Canadian Journal of Physics, 29(5):403-426, Sept. 1951. diagrs., graphs, tables, refs. DWB--Description and discussion of the experiments on meteoric echo observations by radar that have been conducted at Ottawa, Canada, since the summer of 1947 on 9.2, 5.4, and 2.8 wave lengths with various transmitter powers and antenna systems. The results support LOVELL's scattering formula. The following was observed: 1) a decrease of detectable echoes with decreased wave lengths, and 2) a distinct difference between the size distribution of strong shower meteors and that of the normal background meteors. (Met. Abst. 3.5-38)--W. N.

B-204 McKinley, D. W. R., Effect of radar sensitivity on meteor echo durations. Canadian Journal of Physics, 31(5):758-767, July 1953. 5 figs., 2 tables, 9 refs., 9 eqs. DWB--Meteor echo durations were observed simultaneously with two radar systems having a power sensitivity ratio of 33 db. An experimental relation between echo duration and system sensitivity is obtained which shows that the duration of meteor echoes varies slowly, but significantly, with system parameters. Curves are furnished to correct observed durations to zenithal durations, applicable to any system using a horizontal half wave dipole antenna. (Met. Abst. 8H-32)--Author's abstract.

B-205 McKinley, D. W. R., Meteor echo duration and radio wave length. Canadian Journal of Physics, 31(7):1121-1135, Nov. 1953. 5 figs., 7 tables, 8 refs. DWB--The duration of radar echoes from meteors has been observed simultaneously on 9.22 m and 5.35 m, and also on 9.22 m and 2.83 m. The ratio of durations on two wave lengths decreases with increasing duration by a factor of two over the observed range, deviating significantly from the accepted square law of wave length. Plotting the log of the ratio against the log of the duration yields two straight lines of different slopes, one in the short-duration range and the other applying to the longer echoes. General empirical formulas are developed to predict the echo duration on one radio equipment in terms of the duration of the same echo recorded by another apparatus of different sensitivity and wave length. (Met. Abst. 8H-33)--Author's abstract.

B-206 McKinley, D. W. R., Dependence of integrated duration of meteor echoes on wavelength and sensitivity. Canadian Journal of Physics, 32(7):450-467, July 1954. 7 figs., 9 tables, 13 refs. DLC--For short or long duration meteor echoes, using 9.22, 5.35, and 2.83 meters wavelength, finds fractional time that integrated echoes are above a certain threshold varies as the 3.5th power of the wavelength. The integrated echo power is found to vary as the 6.3th power of the wavelength. Emphasizes that short duration echoes behave as a line-scattering source, while long duration echoes scatter in all directions. Plots logarithm of number of echoes versus the log of the duration they exceed, gets straight line of slope about –0.75. Estimates forward scattered signal from meteors, and applies results to the Cedar Rapids – Sterling experiment. Suggests that those results might be explained almost entirely on the basis of meteor reflections. --L. A. Manning.

B-207 McKinley, D. W. R., Determination a l'aide de radar des hauteurs et des radiants des météores d'essaim. (Radar measurement of the heights and radiants of meteor showers.) Académie des Sciences, Paris, Comptes Rendus, 238(23): 2224-2225, June 9, 1954. 3 refs. DWB--In connection with various studies in which it was attempted to locate swarms of meteorites by investigating the distribution of meteor trails, the author discusses the effect of (a) zenithal distance of the radiant and (b) meteor velocity on the height distribution of meteor trails. (Met. Abst. 5.11-210)--G.T.

B-208 McKinley, D. W. R. (National Res. Council, Ottawa, Canada), The meteoric head echo. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 65-72. 6 figs., 5 refs., eqs.) DWB--Two meteoric head echoes are examined in detail, and it is shown that the diffraction theory proposed by BROWNE and KAISER does not agree with the observations. The diffraction theory is satisfactory for the fainter meteors, which do not have true head echoes, but for the bright meteors it is believed that a "moving ball" target accompanying the meteor head must be postulated to explain the observed head echoes. It is admittedly difficult to visualize physical processes which could account for this transient echo, though some tentative suggestions are put forward. (Met. Abst. 8H-66)--Author's abstract.

B-209 McKinley, D. W. R. (Natl. Res. Council, Canada), Radio determination of the orbit of the Eta Aquarid meteors. Astrophysical Journal, Chic., 122(3):513-519, Nov. 1955. 4 figs., table, 11 refs. DWB, DLC--From an analysis of radio echo data obtained on May 4-5, 1949, the mean observed velocity of the η - Aquarid meteors is determined to be 64.4 km/sec, and the corrected geocentric velocity to be 64.6 km/sec. A position at R. A. 330°, Dec. 0°, is found for the η - Aquarid radiant. With these data an orbit was computed with an eccentricity of 0.83, an inclination of 157°.8, and a period of 8.0 years. Some further remarks on the δ -Aquarid shower of July 1949, are appended, and the observed velocity is corrected to give a geocentric velocity of 40.9 km/sec for the δ - Aquarid meteors. (Met. Abst. 8H-67)--Author's abstract.

B-210 McKinley, D. W. R. and McNamara, A. G. (both, National Research Laboratories, Ottawa), Meteoric echoes observed simultaneously by back scatter and forward scatter. Canadian Journal of Physics, Ottawa, 34(7):625-637, July 1956. 10 figs., table, 9 refs., eqs. DWB, DLC--Simultaneous observations of back-scatter and forward-scatter meteoric echoes have been made by means of a high-power 33 M/c sec pulse transmitter at Ottawa, with identical receiving systems at Ottawa and at Scarboro, 337.8 km distant. Two-way transmissions, employing a low-power transmitter at Scarboro, were also used to measure absolute time delays. The approximate position of each meteor was plotted from the observed time delays, which enabled corrections to be applied to the echo durations for variations in antenna patterns and other factors, and which also determined the forward-scatter angle, 2 ϕ, for each meteor, In the majority of cases an enhancement was observed in the forward-scatter duration relative to the back-scatter duration. The data were divided into a short-duration or underdense group and a long-duration or overdense group. Assuming a theoretical forward-scatter enhancement proportional to sec ϕ , it was found that the exponent, m, was 1.73 for the underdense group and 1.13 for the overdense group. (Met. Abst. 8.3-315)--Authors' abstract.

B-211 McKinley, D. W. R., Radar-echo duration and height of a Perseid meteor. Journal of Atmospheric and Terrestrial Physics, London, 8(1/2):76-82, Feb. 1956. 4 figs., 2 tables, 7 refs. DWB--Three-station radar observations of a Perseid meteor on Aug. 12, 1948, in Canada, lasting 549 sec, enabled path to be determined. The enduring echo at 91 km drifted eastward at 119 m/s. Additional diffuse echoes may be due either to ground scatter or to meteoric ionization above 130 km. (Met. Abst. 7.8-252)--C. E. P. B.

B-212 McKinley, D. W. R., Some factors affecting the radio determination of meteoric velocities. Naturwissenschaften, Berlin, 43(10):221-222, May 15, 1956. 6 refs. DWB--The discrepancy between radio and visual determinations of meteor velocities is discussed. Deceleration along the path prior to the point of radio measurement may be important in slow meteors. (Met. Abst. 8H-83)--C. E. P. B.

B-213 McNamara, A. G. and McKinley, D. W. R. (Natl. Res. Council, Ottawa), The effect of trail irregularities on the interpretation of meteor echoes. Journal of Atmospheric and Terrestrial Physics, N. Y., 16(1/2):156-159, Oct. 1959. 6 refs., eq. DWB, DLC--A brief discussion of some points raised in a recent paper by MANNING on obliquely scattered meteor echoes, is followed by the suggestion that the initial distribution of ionization along a typical meteor trail is markedly irregular. Several tentative hypotheses are advanced to account for the irregularities. (Met. Abst. 11. 7-131)--Authors' abstract.

B-214 McNish, A. G. (Cen. Rad. Prop. Lab. U. S. Nat. Bur. of Standards), A study of radio reflections from meteor trails in research on the upper atmosphere. U. S. Air Force. Cambridge Research Center, Geophysical Research Papers, No. 7:105-106, Dec. 1950. DWB--Abstract of the paper, presented at the Conference on Ionospheric Research in June 1949. Data indicate that meteors are not responsible for most of the sporadic E reflections. (Met. Abst. 4. 11-92)--A. A.

B-215 Mainstone, J. S., The calculation of meteor velocities from continuous wave radio diffraction effects from trails. Royal Astronomical Society, Monthly Notices, 120(6):517-629, 1960. --The theory of continuous wave radio diffraction effects from meteor trails is reviewed and it is shown that the zone lengths corresponding to the pairs of maxima of the echo wave form used for velocity measurements depend on the phase relationship between the ground wave and the wave reflected from the trail. Large errors can arise if no account is taken of this relationship. A new method of analysis for c. w. echoes is proposed and a comparison is made with other methods. It is shown that with this method it is possible to measure meteor orbits with a c. w. system. A discussion of the factors affecting the accuracy of measurements made with new equipment at Adelaide is given, together with some preliminary results. --Physics Abstract 14403.

B-216 Manning, L. A.; Helliwell, R. A.; Villard, O. G., Jr. and Evans, W. E., Jr., On the detection of meteors by radio. Physical Review, 70(9/10):767-768, Nov. 1/15, 1946. 5 refs.--Observed meteor whistles and bursts during Giacobini-Zinner meteor shower of Oct. 1946. Observed whistles using a 100 kw broadcast station on 15 Mc/s, within skip zone. Also used a 0.7 kw locally generated signal, with the direct ray nulled out. Noted correlation between whistles and visual meteors. Found all bursts on local 29 Mc/s carrier associated with whistles on 15 Mc/s. --L. A. Manning.

B-217 Manning, L. A., The theory of the radio detection of meteors. Journal of Applied Physics, 19(8):689-699, Aug. 1948. 10 figs., 10 refs., 9 eqs. --Describes the conditions under which "bursts" and "meteor whistles" may be detected. Obtained as many as two meteor whistles per second while listening to 50 kw short-wave broadcast station. Explains "down" or falling pitch whistles as being associated with the rate of formation of the leading end of the ionization column; bursts are explained as due to normal reflection from the fully formed ionization column. Whistles of rising pitch are incorrectly indicated as occurring after the burst, and as a result of reflection from the tail of the fully formed ionization column. A formula is derived which relates meteor velocity, echo range, and the rate of change of whistle pitch. The problem involved in determining the orientation and position of a meteor trail by triangulation is treated, and a method for reducing the resultant data presented. The effect of aspect sensitivity on meteoric detection rates is investigated, and formulae are given for the fraction of meteors from given radiants that can be detected using non-directional aerials. --L. A. Manning.

B-218 Manning, L. A., Villard, O. G., Jr., and Peterson, A. M., Meteoric echo study of upper atmosphere winds. Institute of Radio Engineers, Proceedings, 38(8):877-883, Aug. 1950. 11 figs., 12 refs., 11 eqs. DLC--Movements of ionized meteor trails in the 80 to 100 km region (ionosphere) are subjected to analysis by means of a statistical study of the Doppler effect produced by the drift on radio reflections. Average winds of 125 km/hr (subject to a possible 20% error) prevailing from the southwest and north were obtained in the summer of 1949. Equipment, methods of observation and theory discussed and illustrated. (Met. Abst. 2.1-124)--M. R.

B-219 Manning, L. A., Windmessungen in der oberen Atmosphäre. (Wind measurements in the upper atmosphere.) Umschau, Frankfurt a. M., 51(8):245-246, April 1951. 2 figs. DLC--Popular report on measurement of wind velocity at heights of 50 to 70 miles, by radar echoes from ionization trails persisting after the passage of meteors, as carried out at Stanford University, California. An explanatory schematic drawing and data on wind velocity recorded during the summer 1949 are presented. (Met. Abst. 3. 7-144)--G. T.

B-220 Manning, L. A.; Villard, O. G., Jr. and Peterson, A. M. (Electronic Res. Lab. of Dept. of Elec. Engr., Stanford Univ.), Double-Doppler study of meteoric echoes. Journal of Geophysical Research, 57(3):387-403, Sept. 1952. 15 figs., 8 refs., 7 eqs. DWB--The study of meteoric echoes is greatly facilitated by the use of a twin-channel Doppler presentation, by means of which both the amplitude and phase of the returned signal may be determined independently. Such a "double-Doppler" system has direct application to the verification of the mechanism of meteor-whistle formation, to the determination of the motion of ionization trails drifting under the influence of upper air winds, and to spectrum analysis of those echoes which exhibit amplitude fading. Examples of the application of double-Doppler technique to these problems are presented. (Met. Abst. 5. 11-211)--Authors' abstract.

B-221 Manning, L. A., Villard, O. G., Jr. and Peterson, A. M. (Dept. of Electrical Engr., Stanford Univ., Calif.), The length of ionized meteor trails. American Geophysical Union, Transactions, 34(1):16-21, Feb. 1953. 4 figs., 7 refs., 3 eqs. MH-BH--Employing a statistical method for simultaneous measurements of sixth magnitude meteors made at two meteor detection stations 100 km apart, a mean trail length of 25-30 km was obtained. Velocity of individual meteors used in the test was not known. (Met. Abst. 5. 9-300)--A. A.

B-222 Manning, L. A., Meteoric radio echoes. Stanford Univ., Electronics Laboratories, Contract N6onr 251(07), Technical Report No. 66, July 15, 1953. Unchecked. --For published paper see item B-226.

B-223 Manning, Laurence A. (Stanford Univ., Calif.), Recent advances in the study of ionospheric winds. American Meteorological Society, Bulletin, 34(9):401-405, Nov. 1953. 6 figs., 4 refs. MH-BH--Two radio methods of ionospheric wind observation and the meteoric method are described in detail and illustrated. (Met. Abst. 5. 8-25)--M. R.

B-224 Manning, Laurence A. (Stanford Univ., Elec. Engr. Dept., Electronics Res. Lab., Calif.), The strength of meteoric echoes from dense columns. Journal of Atmospheric and Terrestrial Physics, London, 4(4/5):219-225, 1953. 4 figs., 3 refs., 13 eqs. DWB--Calculation of the strength of the echoes from dense meteoric ionization columns has been made in the past by assuming that the trails behave like perfectly reflecting cylinders of that radius for which the refractive index is zero. It is shown that this procedure neglects the defocusing effect of refraction at greater radii. A general formula is obtained for the effect of refraction on echo strength. The maximum power returned from a large dense Gaussian distribution of ionization is found to be only 70% of that assumed previously. (Met. Abst. 8H-113)--Author's abstract.

B-225 Manning, L. A.; Peterson, A. M. and Villard, O. G., Jr., Ionospheric wind analysis by meteoric echo techniques. Journal of Geophysical Research, Wash., D. C., 59(1): 47-62, March 1954. 8 figs., 6 refs., table, 25 eqs. Also issued as Stanford Univ. Electronics Research Laboratory, Contract N6onr-251, Task 7(NR 073-360), Technical Report No. 60, Feb. 15, 1953. 29 p. 8 figs., table, 6 refs., eqs. DWB--The meteoric method for finding the velocities of winds in the lower E region is extended. The previously given procedure for finding vector-average wind is shown to be unaffected by the presence of turbulent wind components. A new procedure is worked out for finding root-mean-square values of the horizontal and vertical wind components. By looking at the statistics of the reduction procedures, estimates of the accuracies of the method are found; the sources of error are discussed. Relationships between sample size and accuracy are given. Typical results of the methods are presented. (Met. Abst. 6.2-227)--Authors' abstract.

B-226 Manning, L. A., Meteoric radio echoes. Institute of Radio Engineers, Transactions, AP-2:82-90, April 1954. 6 figs., 38 refs.--Classifies meteoric studies in terms of use in a) astronomy, b) upper atmospheric physics, and c) radio propagation. Surveys state of the art and critically reviews the study of meteoric radiants, meteor velocities, rates, processes in the ionization trail, winds, oblique meteor supported signals, and the contribution of meteors to the E region.--Author's abstract.

B-227 Manning, L. A. and Eshleman, V. R., Discussion of the Booker and Cohen paper: A theory of long-duration meteor echoes based on atmospheric turbulence with experimental confirmation. Journal of Geophysical Research, 62(3):367-371, Sept. 1957. fig., table, 9 refs. DLC--Experimental evidence offered in support of Booker and Cohen's theory is examined point by point. It is concluded that the theory does not accurately represent the properties of meteoric echoes. (Met. Abst. 10.8-130)--Authors' abstract.

B-228 Manning, L. A., Oblique echoes from over-dense meteor trails. Stanford University, Electronics Laboratories, Contract Nonr 225(24), Technical Report No. 29, Feb. 28, 1958. Unchecked--For published paper see item 234.

B-229 Manning, L. A. (Radio Propagation Lab., Stanford Univ.), The initial radius of meteoric ionization trails. Journal of Geophysical Research, Wash., D. C., 63(1):181-196, March 1958. 6 figs., table, 4 refs., 27 eqs. DLC--The formation about the path of a meteor of regions of ionized and neutral atoms of meteoric material is investigated from the viewpoint of kinetic theory. It is found that the high initial velocity of the diffusing particles causes the trail to quickly reach an "initial radius" from which normal diffusion then proceeds. It is shown that the reflected signal may, for most purposes, be computed on the assumption that the trail reaches this initial radius instantaneously. The value of the initial radius is approximately 14 mean-free-paths; it is thus greater for the neutral than for the ionized trail. It is shown that at very high frequencies the initial radius may reduce the amplitude of the returned signal from under-dense trails by as much as 50 db. If heating is neglected, it is shown that the effect of initial radius on over-dense trails is marked at the same heights and frequencies as for under-dense trails. (Met. Abst. 10.1-352)--Author's abstract.

B-230 Manning, L. A. and Eshleman, V. R. (both, Radio Propagation Lab., Stanford Univ., Calif.), Concerning Booker's theory of meteoric reflections. Journal of Geophysical Research, Wash., D. C., 63(4, Pt. 1):737-739, Dec. 1958. 6 refs. DWB, DLC--The authors in a previous paper (see abstract, ref. no. 17), discussed the theory of BOOKER on the spectrum of turbulence of meteoric echoes and concluded that the small scale (down to 1.3 m with a velocity of 3 m/s) theory does not agree with evidence. In this note they give arguments against the small scale theory: it does not explain aspect sensitivity by under-dense or over-dense trails, the angular spectrum, or the echo decay curves.

In the ionosphere many factors tend to make theoretical predictions doubtful: lack of isotropicity, lapse in temperature and density, sporadic ionization layers, localization of turbulence areas, magnetic fields and field aligned reflecting surfaces. (Met. Abst. 11.10-112)--M.R.

B-231 Manning, L. A., Air motions and the fading, diversity and aspect sensitivity of meteoric echoes. Journal of Geophysical Research, 64(10):1415-1425, Oct. 1959. 9 figs., 13 refs., 6 eqs. DLC--A theory is presented which relates those properties of meteoric echoes that depend on distortion of the trail by winds. It is shown that existing results on the delay in the start of echo fading, the delay in echo appearance with aspect, the spectral composition of the received signal, and the regularity of the fading pattern are qualitatively explicable. In addition, the theory predicts that the ensemble-average rate of echo fading should rise characteristically with time and should then drop precipitously at the end of the ensemble echo; moreover, it predicts that the correlation of fading patterns at two ground receivers should be a Gaussian function of the product of receiver spacing and echo fading cycle number. Experimental results are given which confirm these predictions and make possible the determination of the principal properties of the wind profile. It is concluded that at the times of observation, the small scale cutoff wavelength of the turbulence spectrum was about a kilometer, that lack of correlation of wind velocities existed in a vertical range of about a scale height, that the rms variable component of N-S wind velocity was about 50 m/s, and that the rms value of the relative maxima of the vertical gradient of a component of the wind velocity was about 100 m/s. These figures agree with Whipple's photographic studies of meteor trails. --Author's abstract.

B-232 Manning, L. A. (Radio Propagation Lab., Stanford Univ., Calif.), Air motions at meteoric heights. Journal of Atmospheric and Terrestrial Physics, London, 15(1/2):137-140, Sept. 1959. 10 refs. DLC--The results of a method of analyzing the detailed wind structure at meteoric heights based on the fading, diversity, and aspect properties of meteor echoes is presented. The method is based on the assumption that a meteor entering the 80-110 km height region produces an initially straight column of ionization of about 25 km height which is acted on by horizontal winds varying in direction and magnitude by height. A consistent picture of the wind structure obtained is described. (Met. Abst. 11.10-109)--O.T.

B-233 Manning, L. A. and Eshleman, V. R., Meteors in the ionosphere. Institute of Radio Engineers, N. Y., Proceedings, 47(2):186-199, Feb. 1959. 7 figs., table, 65 refs., 32 eqs. DLC--When meteors enter the lower E region of the ionosphere, they produce trails of ionization. Sensitive radio systems at frequencies of 3 to 300 mc can record echoes from these ionized trails at rates of thousands per hour. Study of these echoes has benefited astronomy, the physics of the upper atmosphere and radio communication. This paper presents a review of the nature of meteoric echoes and describes the principal uses of meteors as research tools. Some of the directions in which further meteoric research may prove profitable are suggested as well. When the results of the IGY programs are correlated we may expect the knowledge gained from the study of meteors to play an important role. (Met. Abst. 11E-95)--

B-234 Manning, L. A. (Stanford Univ., Stanford, Calif.), Oblique echoes from over-dense meteor trails. Journal of Atmospheric and Terrestrial Physics, London, 14(1/2):82-93, April 1959. 9 figs., 8 refs., 21 eqs. DLC--Ray paths are computed for waves refracted by meteor trails having a Gaussian radial distribution of ionization density. From the spreading of initially parallel rays as they pass through the trail, a measure of reflected signal intensity vs. scattering angle is obtained; the results are presented in polar scattering diagrams, valid in the limit of large trail size. Equivalence theorems are derived relating both intensity and scattering angle for rays incident upon the trail at an arbitrary angle to the intensity and scattering angle for rays incident in the plane normal to the trail. Curves are presented showing the dependence of echo duration on forward-scatter-angle with trail orientation as parameter; it is found that the $\sec^2 \phi$ law developed for underdense trails applies to over-dense trails only if the plane of propagation contains the trail axis. If not, the effective secant exponent may be as small as 0.3. The theory is compared with McKinley and McNamara's duration measurements. It is found that although the general agreement is satisfactory, the details of their experimental results depend on the way that winds change the trail orientation. The ray theory is also compared with Keitel's wave theory solution. Unfortunately, he could not get wave solutions for dense trails of age greater than 0.35% of the minimum echo duration. Even so, the ray solutions agree with Keitel's results for scatter angles up to 155°, thus including all angles available to ground-based stations. (Met. Abst. 11.9-104)--Author's abstract.

B-235 Maris, H. G., Theory of meteors. Terrestrial Magnetism and Atmospheric Electricity, 34:309, 1929. DLC--The energy of impact between a molecule of atmospheric nitrogen and a meteor moving at the rate of 4×10^6 cm/sec is sufficient to vaporize 56 molecules of iron from the solid state to a gas at $3000^{\circ}K$, or is equal to the energy of an electron dropped through about 200 volts. It is assumed that the result would be a miniature explosion, which would drive from 10 to 100 molecules out of the main mass of the meteor. The energy of the average meteor is observed to be dissipated within roughly 1.5 sec after entering the upper atmosphere. As the resistance of the air to the solid mass of the meteor can account for only about 1% of the total energy loss, and radiation from the surface of the meteor for less than 1% of the total radiation, most of the energy of the meteor is dissipated and changed to radiant energy by the high energy atoms and molecules which escape from the meteor and communicate their energy to the air by collision with air molecules. The meteor flashes into view when the energy of molecules escaping from it is sufficient to support the radiation of the trail. Impacts between air-molecules in the path of the meteor and escaping molecules prevent an increase in brilliancy as the meteor moves from the height of appearance to denser strata of air. At a height of about 60 to 80 km a compressed air-cap is formed in front of the meteor, which prevents further direct impacts between the meteor and stationary air-molecules. (Met. Abst. 8H-1)--Author's abstract.

B-236 Meadows, R. W., The direction and amplitude of reflections from meteor trails and sporadic E ionization on a 1740 km north-south path at very high frequencies. Institution of Electrical Engineers, Journal, Pt. B, Vol. 105, Suppl. No. 8:56-64, 78, 1958. 6 figs., 7 tables, 10 refs. Unchecked.

B-237 Meeks, M. L. and James, J. C., On the influence of meteor-radiant distributions in meteor-scatter communications. Institute of Radio Engineers, Proceedings, 45(12):1724-1733, Dec. 1957. 16 figs., 19 refs., 16 eqs. DLC--The relative effectiveness of various regions of the atmosphere in furnishing usable meteor trails is examined on the basis of several distributions of meteor radiants. An idealized distribution in which the radiants lie near the ecliptic is analyzed and the results compared with previous calculations for a uniform radiant distribution. Experimental data on a 250 km link between Knoxville, Tenn., and Atlanta, Ga., show evidence of a rather diffuse concentration of radiants near the ecliptic. A method for predicting the contributions of meteor showers to forward-scatter propagation is developed. As an example, the August Perseid shower is studied on the Knoxville-Atlanta link. Experimental data show good agreement with the shower analysis. (Met. Abst. 10. 5-330)--Authors' abstract.

B-238 Meeks, M. L. and James, J. C., On the choice of frequencies for meteor-burst communication. Institute of Radio Engineers, Proceedings, 46(11):1871, Nov. 1958. table, 2 refs. --Experimental transmission over a 1250 km path using 49 and 74 Mc monitored simultaneously at Columbia are discussed in favor of the use of higher frequencies. Comparison of duty cycles measured at 10 db above average peak background signal is tabulated. --W. N.

B-239 Meeks, M. L. and James, J. C. (both, Georgia Inst. of Technology), Meteor radiant distributions and the radio echo rates observed by forward scatter. Journal of Atmospheric and Terrestrial Physics, N. Y., 16(3/4):228-235, Nov. 1959. 4 figs., table, 10 refs. DWB, DLC--The diurnal variations in sporadic meteor echo rate observed by the forward scattering of radio waves over three different paths are compared with predictions based on a simplified model of the average radiant distribution which has been obtained from radar data by HAWKINS. Our simplified distribution is composed of three hypothetical meteor showers with radiants at the apex of the earth's way and at points in the ecliptic at angles $\pm 65^\circ$ from the apex. Reasonably good agreement is found between these predictions and extensive measurements reported by VOGAN and CAMPBELL. Additional measurements reported here for two paths – Boston, Mass to Atlanta, Ga. (1480 km) and Boston, Mass. to Columbia, S. C. (1250 km) also show similar agreement. Evidence of the concentrations of radiants near the sun and antihelion points appear in the average diurnal rate for periods of about 1 month. In general forward scatter measurements appear consistent with HAWKINS' radiant distribution. (Met. Abst. 11. 7-132).

B-240 Millman, P. M. and McKinley, D. W. R., A note on four complex meteor radar echoes. Royal Astronomical Society of Canada, Journal, 42(3):121-130, May-June 1948. 2 figs., tables, 5 refs. DLC--One Geminid and three Lyrid radar echoes at 90 km elevation are described in some detail. The echoes have an enduring portion of complex character, and have an instantaneous component which seem to move with the velocity of the meteor. Measurements indicate 35 km and 48 km/sec, respectively, for the Geminid and Lyrid. --From authors' abstract.

B-241 Millman, P. M. and McKinley, D. W. R., Three station radar and visual triangulation of meteors. Sky and Telescope, 8(5):114-116, March 1949. 4 figs. DLC--Show sample records of meteor reflections on range-time presentation. The frequency was between 30 and 36 Mc/s, power as high as 400 peak kilowatts. Established three pulse stations separated by 36, 41, and 57 kilometers. Obtained reflection heights by triangulation of the three ranges, and also with the aid of visually observed paths. For 41 meteors the night of Aug. 11-12, 1948 (Perseid shower), the radar heights varied from 79 to 112 kilometers, with a mean of 94 km. Plot the height distributions obtained by radar alone, by radar-visual computation, and by visual computation, Use of visual data resulted in a much greater spread in the results. The echoes on which triangulation was attempted were all of duration greater than a second. --L. A. Manning.

B-242 Millman, Peter M. (Dominion Observatory, Ottawa, Canada), Meteoric ionization (and discussion). U. S. Air Force. Cambridge Research Center, Geophysical Research Papers, No. 11:204-224, 1952. figs., 44 refs. DWB--Discusses meteoric ionization as a physical phenomenon in the ionosphere. After briefly summarizing its general nature, author deals with (1) the basic ionization (produced directly along the moving line of the meteors) and (2) the secondary ionization (produced around the meteor itself by strong ultraviolet radiation). Visual meteor train observations give evidence of high wind velocities in the upper atmosphere and reference is made to the promising method recently advanced by MANNING, VILLARD and PETERSON (using the frequency shift in their Doppler record) to study this phenomenon. (Met. Abst. 6E-118)--W. N.

B-243 Millman, Peter M. (Dominion Obs., Ottawa), Radio observations of meteors. Science, Wash., D. C., 120(3113):325-328, Aug. 27, 1954. 3 figs., 2 tables, 21 refs. DLC--The development of powerful radio equipment during the war led to a rapid increase of scientific knowledge about meteors, which is here briefly summarized. A good linear relation derived from 900 height determinations exists between the mean heights of meteoric ionization and the velocity of meteors (88 km at 20 km s^{-1}, 100 km at 60 km s^{-1}). The frequency distribution of 11,000 meteor velocities observed in Canada, and 3000 in England show a remarkable agreement, with planes at 37 and 60 km/s and a mean velocity of 45 km/s. This shows that at least up to the 9th magnitude ($\emptyset$1 mm) the meteors are members of the solar system. Ionospheric winds up to 50 m/s in the horizontal direction and up to 10 m/s in the vertical are normal. The average horizontal drift is 25 m/s with a negligible vertical drift. Meteoric orbits are derived (1.5 to 7.2 years with a high eccentricity, 0.74 to 0.96 with a low eccentricity), and the ionospheric stratification is discussed. (Met. Abst. 8H-45)--A. A.

B-244 Millman, Peter M. and McKinley, D. W. R., Meteor echo durations and visual magnitudes. Canadian Journal of Physics, Ottawa, 34(1):50-61, Jan. 1956. 4 figs., 7 tables, 11 refs., 7 eqs. DWB, DLC--The statistical relation between the radio echo duration and the visual magnitude has been investigated for approximately 3300 meteors observed on the combined Dominion Observatory-National Research Council program at Ottawa. Both echo durations and visual magnitudes were reduced to absolute values, defined as those for a meteor in the zenith at a height of 100 km. For meteors in the absolute magnitude range +5 to −5 a straight line relation exists between log absolute duration and absolute magnitude, longer durations corresponding to brighter meteors. Applying current meteor theory to these data indicates that a meteor of absolute magnitude + 5 produces 2×10^{12} electrons per cm of path length. For Perseid meteors the ratio between ionization produced and visual luminosity is almost constant in the range +5 to −5 absolute magnitude. For other meteors this ratio seems to decrease somewhat for the brighter objects. These results lead to higher electron densities for the bright meteors than had previously been estimated. (Met. Abst. 8.3-316)--Authors' abstract.

B-245 Millman, Peter M., Upper atmosphere and current research. Royal Astronomical Society of Canada, Journal, 51(6):334-340, Dec. 1957. 2 figs. DLC--A review of research on the upper atmosphere reported at the Boulder, Colo., assembly of the U.R.S.I. (XII) and the Toronto Assembly of the I.U.G.G. (XI), in August and Sept. 1957, respectively. Subjects of particular interest dwelled on are: 1) Whistlers, 2) Ozone, 3) Airglow, 4) Auroral temperatures, 5) Auroral cameras, 6) Fine structure of the ionosphere, 7) Ionospheric winds, 8) Meteor ionization, 9) Meteor velocities. (Met. Abst. 10.7-183)--M. R.

B-246 Millman, P. M. (Nat. Res. Council, Ottawa, Canada), Note on some observational characteristics of meteor radio echoes. Journal of Geophysical Research, Wash., D. C., 64(12):2192-2194, Dec. 1959. 2 photos, 2 refs. DLC--Attention is called to the observational evidence for meteor echoes from portions of the path well removed from the position of minimum range. Fading periods for echoes observed at Ottawa are given. --Author's abstract.

B-247 Mirtov, B. A., O mekhanizme obrazovaniia meteornogo sleda. (Mechanism of formation of a meteor trail.) Astronomicheskii Zhurnal, Moscow, 37(3):513-516, May/June 1960. 2 figs., 7 refs., 3 eqs. Russian and English summaries p. 513. Transl. into English in Soviet Astronomy A. J., New York, 4(3), 1960. DLC--It is shown that molecules escaping from a meteor body have a possibility, before their first collision with molecules of the medium, of moving away from the meteor body. The distance is larger, the greater the velocity of the molecule. Thus there is a division of molecules of evaporating meteor matter, which have small thermal velocities, from molecules of the air which are repelled from the surface of the meteor with exceedingly large velocities. In connection with this the double trail observed for some fast meteors can be explained: the outer ionized cylinder should be of atmospheric origin, the inner bright and narrow core - mainly of evaporating meteor matter origin. (Met. Abst. 11.12-156)--Author's abstract.

B-248 Mitra, Sisir K., Meteoric phenomena. (In his: The upper atmosphere. 2nd ed. Calcutta, The Asiatic Society (preface 1952). p. 75-118. 21 figs., 2 tables, 57 refs. (p. 645-647), 35 eqs. DWB--In this chapter MITRA discusses first the classification and composition of meteors. This is followed by sections on meteor observation (visual and photographic) and meteor theories (particularly those of LINDEMANN and DOBSON, SPARROW, and OPIK). The remainder of the chapter deals with the radio echo (or radar) method of observing meteors. An excellent bibliography, covering the literature from 1923, is included. (Met. Abst. 8H-21)--M.L.R.

B-249 Montgomery, G. Franklin, Intermittent communication with a fluctuating signal. Institute of Radio Engineers, Proceedings, 45(12):1678-1674, Dec. 1957. 5 figs., 6 refs., 41 eqs. DLC--The method discussed is shown to reduce message errors due to fluctuating signal amplitude. A theoretical power gain $>$ 40 db for binary angle modulation with an error of 10^{-6} may stand well against possible practical limitations. --W. N.

B-250 Montgomery, G. F. and Sugar, G. R., The utility of meteor bursts for intermittent radio communication. Institute of Radio Engineers, Proceedings, 45(12):1684-1693, Dec. 1957. 14 figs., table, 15 refs., 22 eqs. DLC--It has been suggested that the transient vhf signal produced by meteor ionization be used for communication, and several groups have been investigating this possibility. Analysis of the meteor bursts measured on the 49.8 mc transmissions from Cedar Rapids, Iowa, to Sterling, Va., implies that useful intermittent communication can be achieved. Transmission experiments in a 100 kc band have not realized the theoretical capacity of the signal, mostly because of multipath propagation. About half of the meteor bursts observed are unaffected by this distortion, however, so that a useful system of this bandwidth may yet be possible. (Met. Abst. 10.1-338)--Authors' abstract.

B-251 Montgomery, G. Franklin (Natl. Bureau of Standards, Wash., D. C.), On the transmission error function for meteor-burst communication. Institute of Radio Engineers, Proceedings, 46(7):1423-1424, July 1958. fig., 3 foot-refs., 6 eqs. DWB, DLC--A graph shows threshold carrier to noise ratio r, for a = 1.2 for calculating fractional binary error for meteor burst communication using narrow band frequency modulation which depends also on meteor characteristics (a). (Met. Abst. 11.8-320)--M. R.

B-252 Moorcroft, D. R. and Hines, C. O., Resonance effects in the theory of meteor observability. Canadian Journal of Physics, 36(1):134-136, Jan. 1958. fig., 9 refs. DLC--Contours of meteor observability as a function of trail orientation are discussed in comparison with the original theory. It is indicated that averaging the new and the old contours may yield improved empirical contours. --W. N.

B-253 Murray, E. L. (Physics Dept., Univ. of Adelaide), Ambipolar diffusion of a meteor trail and its relation with height. Planetary and Space Science, N. Y., 1(2):125-129, April 1959. 3 figs., table, 10 refs., 3 eqs. DWB--Investigation of the relation between the ambipolar diffusion coefficient, D, of a meteor trail and height shows that considerable random fluctuations occur. It is however possible to obtain a statistical relation between these parameters. Regression lines have been derived for the relation between log D and height and it is shown that care must be exercised in the correct choice of the two possible regression lines. (Met. Abst. 11.4-104)--Author's abstract.

B-254 Nagaoka, Hantaro, Possibility of the radio transmission being disturbed by meteoric showers. Tokyo Imperial Academy, Proceedings, 5(6):233-236, June 1929. tables. DLC--Evidence of radio disturbances produced by passing meteors is given here. Speed of the passage causes ionization of the already highly ionized layer, whose disturbance appears as irregular as reflections from the height of the Kennely-Heavyside layer. Scattering of the radio waves generally cause weakening, in some cases increase, of the signal intensity. --W. N.

B-255 Naismith, R., A subsidiary layer in the E region of the ionosphere. Journal of Atmospheric and Terrestrial Physics, 5(2):73-82, May 1954. 6 figs., 10 refs. DWB--

Echoes from E layer at vertical incidence can be separated into E (due to UV ionization) Em (meteors) and Es (sporadic meteors). The fEm (highest frequency as observed at Slough) echoes are described (the photos referred to in the text are not reproduced). Seasonal and diurnal variations of fEs (mostly due to fEm) are plotted. Observations at oblique incidence show a fairly defined ionized layer at 90-100 km giving consistent reflection suitable for regular radio communication over a few hundred km. (Met. Abst. 5.8-98)--C.E.P.B.

B-256 Naismith, R., Oblique transmission by the meteoric E layer. Wireless Engineer, London, 33(7):159-162, July 1956. 2 figs., table, 4 refs. DLC--British radar stations on 22.7, 25 and 27 Mc/s were received in Norway (distance 900-1900 km) on 10-30% of the time, but not at 600-700 and >3000 km. Conditions and turbulence in the meteoric E layer are discussed, including solar eclipse effects. Observations at Aberdeen and Weymouth (1000 km apart) showed no systematic differences; this and other evidence suggests that abnormal reception is due to sporadic meteors rather than to turbulence. (Met. Abst. 8.5-182) --C.E.P.B.

B-257 Neuzil, L. (Astron. Inst., Ondrejov, Czechoslovakia), Meteoric influences on the sporadic E layer. (In: Kaiser, T.R. (ed.), Meteors. London, Pergamon Press, 1955. p. 96-98. 4 figs., 2 refs.) DWB--Data on critical frequencies of the Es attained at Freiburg in 1947-9 are compiled to show the annual variation. An asymmetry with regard to the summer solstice (both day and night) corresponds with the fact that the great meteor showers occur after the summer solstice. This relation is shown graphically in several ways. (Met. Abst. 815-321) --M.R.

B-258 Nicolet, Marcel, Meteor ionization and the nighttime E layer. Pennsylvania. State Univ. Ionosphere Research Laboratory, Contract AF 19(122)-44, Scientific Report, No. 72, Nov. 30, 1954. 25 p. 2 tables, 21 refs., 28 eqs. DWB--The nighttime E layer, recombination coefficient in E layer, ionization of meteor atoms, photoionization of meteor atoms, molecular formation, recombination and diffusion are discussed in this report. Data from usual ionospheric recorders were analyzed in order to determine possible ionization effects of meteor atoms. A low value for recombination was used since evidence that a month or more may occur before many meteor atoms which are introduced become involved in specific processes. Hence conclusion is that atmospheric motions are important and "diffusion processes lead to accumulation of meteor atoms near 100 km". (Met. Abst. 6E-167)--M.R.

B-259 North Atlantic Treaty Organization. Advisory Group for Aeronautical Research and Development (AGARD), Papers presented at the Ionospheric Research Meeting, The Hague, Netherlands (July 1-3, 1957). Ed. by Tor Hagfors. AGARDograph, Paris, No. 26, July 1957. 69 p. figs., tables, refs. DWB (629.1322 N864a)--Physical problems of importance in meteor communication are discussed and the information capacity of the JANET system is evaluated theoretically. Experimental results on properties of meteor signals are presented. The Canadian JANET system is described and some operational results are given. Interference problems encountered in scatter communication are reviewed. Experimental results on the artificial production of electron clouds are presented and new communication possibilities are proposed. A collection of eight papers presented at the Ionospheric Research Meeting at the Hague, Netherlands, July 1957. (Met. Abst. 10.2-325) --Author's abstract.

B-260 Őpik, E. J., Meteors and the upper atmosphere. Irish Astronomical Journal, Armagh, 3(6):165-181, June 1955. 6 tables, 32 refs., 5 eqs. DLC. Reprinted as: Armagh, Ireland. Observatory, Leaflet, No. 30. DWB--Up to 75 km the current meteor theory calculations of atmospheric density (Whipple 1943, 1949) check with rocket data obtained at White Sands, N. Mex., above 75 km the calculated densities are about 90% too high (95 km, Whipple, 1952). Author shows that discrepancy in theory could be accounted for by assuming that only hard meteors reach levels < 75 km whereas fluffy or spongy objects, which would crumble into thousands of pieces of dust, would be visible but never reach lower levels. The classical idea that spraying of hot liquid particles occurs from hard meteors would not be refuted by the above hypothesis, as it would deal with a special case. The pressure necessary to break up the "dustballs" would be about 10^4 dynes/cm^2. Ionization is discussed and tables presented for calculating ionizing efficiency of atomic collisions in air, decay of molecular ions in the ionized column of stony meteors through dissociative recombination, and selectivity of radar observations at 8.13 m for average dustball meteors. Radar observations are not considered to be statistically fit to deal with hyperbolic meteors or the general distribution of meteor velocities. (Met. Abst. 7.11-148)--M.R.

B-261 Őpik, Ernst J. (Armagh Obs., Armagh, Northern Ireland), Physics of meteor flight in the atmosphere. N. Y., Interscience Publishers, 1958. 174 p. 14 figs., 55 tables, 64 refs., eqs. DWB (523.5 061ph)--This small book is concerned with phenomena connected with the flight of a meteor through the atmosphere. History of meteor research, meteors as probes of the high atmosphere, evidence of turbulence and diffusion recombination, acoustical phenomena, physico-chemical properties (classification, artificial meteors, trims, spectra, etc.), energy transfer (rotation, pressure, drag, shielding, radiation, sputtering, deceleration), ablation, and relation to atmospheric density and size, atomic collisions, meteor radiation, applications, etc. are treated without neglecting theory, and with inclusion of a great deal of empirical data in tables and graphs. Some of the physical data has been obtained from laboratory model studies. (Met. Abst. 10.7-5) --M. R.

B-262 Okamoto, Hironobu; Ose, Masami and Aida, Kazuo (all, Radio Res. Labs., Kokubunji, Tokyo), New type of scattering echo observed by the shipborne ionospheric sounder over the sea. Japan. Science Council. Ionosphere Research Committee, Report of Ionosphere Research in Japan, 11(2): 50-54, June 1957. 4 figs. DWB--On the first Japanese Antarctic research expedition (1956-57) from Japan to Singapore to Cape Town to Syowa Base and return, a new type of ionospheric sounding echo scattering was observed (as shown on recorder records) in a region up to 120 km above the surface for h'f records. No internal or instrumental failure could be found and, as shown on an hourly graph, a diurnal cycle was predominant (scatter mostly in daytime). Over-sea, land or ice propagation showed differences in type of scatter, being weaker over land or ice than over sea. It apparently is due to tropospheric conditions. (Met. Abst. 11E-111)--M. R.

B-263 Oklahoma. State Univ., Stillwater. Research Foundation, Research directed toward the design, development, and construction of meteoritic microphone detectors of various sensitivities for use in satellites. Contract AF 19(604)-5715, Scientific Report No. 1, Jan. 15, 1960. 20 p. 13 figs., 2 plates, charts. --An electronic system designed for the express purpose of exploiting the data gathering potential of a specific vehicle in obtaining information regarding the influx of micrometeor material has been developed. An acoustic sensing technique is employed, whereby the particulate matter to be detected activates a supersonic microphone device. The resultant electrical signal is amplified to a suitable level, graded as to magnitude, and stored internally by electronic means for subsequent recording and/or telemetering to ground receiving stations by the system inherently available within the chosen vehicle. A brief historical background of the development of the technique is presented, together with details of the specific system evolved for this application. Various design features which are peculiar to this application are presented and discussed. The prototype equipment which resulted from the development program has been subjected to a testing program to verify its suitability for the anticipated use, and several sets are currently under construction. (Met. Abst. 11. 12-155)--Author's abstract.

B-264 Olivier, Charles P., Conditions in the upper atmosphere as indicated by a study of meteor trains. American Geophysical Union, Transactions, 16:32-34, 1935. DWB--Concludes that meteor trains prove that wind velocities of between 100 and 300 km/hr are usual feature of the stratum in which meteor trains appear at night, and that there is good evidence of vertical component. (Met. Abst. 4F-11)--G. J. E.

B-265 Olivier, Charles P., Long enduring meteor trains. American Philosophical Society, Proceedings, 85(2):93-131, Jan. 1942. 3 tables, 2nd Paper, Ibid., 91(4):315-327, Oct. 1947. 11 figs., 2 tables. DWB--Paper I includes lengthy tables giving all salient facts on 1336 trains which persisted long enough to exhibit drift. Table II contains further specific data on heights and drifts for 583 trains and table III gives monthly totals for all years in order of magnitude. Drift velocities from 121 to over 200 km/hr at heights 30-102 km mentioned. Paper II is a revision and enlargement containing data for 156 more recent trains. (Met. Abst. 4F-25)-- M. P. K.

B-266 Olivier, Charles P. (Univ. of Penn.), Long enduring meteor trains and fireball orbits. American Philosophical Society, Proceedings, 101(3):296-315, June 20, 1957. 2 figs., 5 tables, 6 refs. DWB, DLC--The excellent catalog of about 1500 long enduring ($>$10 sec) meteor trails, published by the author in 1942 and 1947 (see ref. no. 265) is brought up to date (1955) by the addition of data for 575 more meteors, and a tabulation of the monthly and annual frequency of 5000 fireballs, and a catalog of 102 fireballs (1913-1955) and their properties. Mean heights, direction of winds in America, Europe and overall seasonal variations, colors, ratios of drift observations to total meteor observations, verification by photographic and radio methods, etc., are discussed and shown in tables and graphs. The enduring meteor trail is a comparatively rare phenomenon, at least for eye observations such as these, constituting only about 1/750 of the total. Night, twilight, and daytime observations are differentiated. Trails are observed much more often in the last half of the year than in the first. Winds were observed most often from the S and W in America; from the E and less often from the N. W. in Europe. Neither directions, speeds or heights are altered much by the supplementary data used in this paper, as can be seen by comparative wind roses. (Met. Abst. 8H-114)--M. R.

B-267 Peregudov, F. I., Zavisimost' vremeni registratsii meteornykh otrazhenii ot parametrov radiolokatsionnoi stantsii. (The dependence of the time of registration of meteor reflections on the radar system parameters.) Astronomicheskii Zhurnal, Moscow, 37(3):530-535, May/June 1950. 2 figs., 8 refs., 17 eqs. Russian and English summaries p. 530. Transl. into English in Soviet Astronomy AJ, New York, 4(3), 1960. DLC--In scientific literature the duration of meteor reflections is estimated at the relative level. This method of measurement of duration is suitable if there is amplitude indication and can lead to essential errors, due to resonance phenomena in the trail. It is more expedient to obtain the time of registration of the meteor reflection, determined by the threshold signal or discrimination level. Theoretical formulas are given for computing the time of registration of reflections from meteor trails of the unstable type. A condition is given for the detection of unstable type trails by a radar system. The deduced formulas are confirmed by McKinley's experiments. (Met. Abst. 11.12-157)--Author's abstract.

B-268 Pierce, J. A., A note on ionization by meteors. Physical Review, 59(8):625-626, April 15, 1941. fig., 7 refs., eqs. DLC--Experimental evidence of atmospheric ionization by meteoric bombardment is presented and may be useful in studying diffusion and recombination in the upper atmosphere and in counting meteors in the daytime or in cloudy weather. (Met. Abst. 8H-5)--Author's abstract.

B-269 Pineo, V. C. and Peck, R. C., A circuit for simultaneously recording the range, amplitude, and duration of radar-type reflections. Review of Scientific Instruments, 22(2):112, Feb. 1951. --Give the circuit of a presentation differing from the usual intensity modulated range-time system in that the length of the recorded pulses in the range direction depends upon the signal amplitude. Apply to meteor echo detection. --L. A. Manning.

B-270 Pineo, V. C. and Gautier, T. N., The wave-frequency dependence of the duration of radar-type echoes from meteor trails. Science, Wash., D. C., 114(2966):460-462, Nov. 2, 1951. 2 figs., 4 refs. --Simultaneous measurements of echo duration at 27.2 Mc/s and 4.10, conducted by the National Bureau of Standards, Nov. 1, 1948-Oct. 1949, are discussed in evidence of Lovell's conclusion that "the duration is approximately proportional to the square of the wavelength". --W. N.

B-271 Pineo, V. C., Experimental observations of the contribution of meteoric ionization to the propagation of VHF radio waves by ionospheric forward scatter. U. S. National Bureau of Standards, NBS Report, 5544, Dec. 19, 1957. 6 p. 7 figs., 10 refs., eq. DWB--The experimental results described in this paper were obtained during the month of Jan. 1956. Cedar Rapids, Iowa, transmissions at 49.8 Mc/s beamed toward Sterling, Va., were recorded simultaneously at Sterling and at two off great-circle path receiving sites, one northerly from Sterling at Shepherdstown, Pa., and the other southerly from Sterling at Carysbrook, Va. Identical rhombic antennas beamed toward the midpoint of the Cedar Rapids to Sterling path were used at each receiving site. Signal intensities at Carysbrook were greater than at either Sterling or Shepherdstown from 0400 hrs to 1115 hrs. Sterling signal intensities were greater than at either Shepherdstown or Carysbrook from 1115 hrs to about 1715 hrs. Shepherdstown signal intensities were greater than at either Sterling or Carysbrook from 1715 hrs to 0400 hrs. Signal intensities at each site reached maximum values during the midday hours. These results indicate that there are two principal propagation modes involved in ionospheric scatter propagation, one due to solar influence, the other due to meteoric ionization. (Met. Abst. 10.2-326)--Author's abstract.

B-272 Prentice, J. P. M.; Lovell, A. C. B., and Banwell, C. J., Radio echo observations of meteors. Royal Astronomical Society, Monthly Notices, 107(2):155-163, 1947. 4 figs., 4 tables, 11 refs., eq. DLC--Describes the equipment used at Jodrell Bank Experimentation Station for investigation of 1836 radio echoes from meteors during June 13-Aug. 14, 1946. The results are discussed in terms of echo characteristics and an approximate relationship between meteoric ionization and echo amplitude, including correlation with visual meteors. --W. N.

B-273 Pugh, Robert E., The number density of meteor trails observable by the forward-scattering of radio waves. Canadian Journal of Physics, Ottawa, 34(10):997-1004, Oct. 1956. 3 figs., 5 refs., 29 eqs. DWB, DLC--The number of meteor trails which can be detected by the forward-scattering of radio waves varies with the region of the sky under observation. The number density is determined theoretically, as a function of position relative to the transmitter and receiver. (Met. Abst. 8H-85)--Author's abstract.

B-274 Rach, R. A., An investigation of storage capacity required for a meteor-burst communication system. Institute of Radio Engineers, Proceedings, 45(12):1707-1709, Dec. 1957. 2 figs., 3 refs., eqs. DLC--The two types of storage devices as used in the Stanford-Bozeman system are discussed theoretically. A method is presented of assessing storage requirements of any meteor burst communication system when certain parameters are available. --W. N.

B-275 Rao, M. Srirama, Analysis of meteoric body Doppler radar records taken during a Geminid shower period. Canadian Journal of Physics, Ottawa, 36(7):840-854, July 1958. 6 figs., 2 tables, 27 refs., 13 eqs. DWB, DLC--The determination of the prevailing wind in the 80-100 km region of the upper atmosphere by a new method, involving the simultaneous use of a CW Doppler radar at 30.02 Mc/sec and three station pulsed radars at about the same frequencies, is presented in this paper. This method involves the determination of the exact location of each observed meteor train and the component of the velocity of its horizontal drift in the direction of the azimuth from Ottawa. A 40-min period during the Geminid shower on the night of Dec. 10/11, 1948 has been selected for this investigation. Theory for the analysis of the body Doppler records is briefly outlined. The prevailing wind speed obtained from the body Doppler frequencies (fd) is 54 m/sec. The observed linear variation in the average fd with time, in the case of each meteor, has been explained as caused by the effective point of reflection drifting along its train toward the maximum echo duration level. Periodic fluctuations of fd of the order of 1-3 c.p.s., on the average, have also been observed. The above two phenomena can be explained from a postulate of atmospheric turbulence on a scale of about 1 km or above. (Met. Abst. 11.2-165)--Author's abstract.

B-276 Rao, M. S. and Armstrong, R. L., Investigation of the drifts of the effective point of radio reflection along a meteor train. Canadian Journal of Physics, 36(12):1601-1623, Dec. 1958. 12 figs., 4 tables, 16 refs. DLC--The effective point, based on atmospheric turbulence, is given on a vertical scale of the order of 100 m to 6 km in the M region. Doppler radar records on 30.02 Mc/s at South Gloucester during the Geminid shower periods 1948-1950 were analyzed and the drift velocity calculated from 90 observations, using simultaneous ranges from pulsed radar observations on 32.7 Mc/s at Metcalfe Road field station, 7.5 km distant. It was found that the higher velocity values go with shorter echo durations and vice versa. The results are discussed theoretically. Reasonable assumptions are made to derive the echo durations from different portions of the meteor train, variation with position is taken into account to calculate the theoretical curves of vertical components of V_3 vs. total echo durations. --From authors' abstract.

B-277 Robertson, D. S.; Liddy, D. T. and Elford, W. G. (all, Adelaide Univ., Physics Dept., S. Australia), Measurements of winds in the upper atmosphere by means of drifting meteor trails, Pt. 1. Journal of Atmospheric and Terrestrial Physics, London, 4(4/5):255-270, 1953. 14 figs., 3 refs., eqs. Also: Elford, W. G. and Robertson, D. S., Measurements.........Pt. 2. Ibid., p. 271-284. 9 figs., table, 9 refs., eqs. DWB. (See ref. no. 63)--Pt. 1 describes some new radio techniques for the measurement of upper atmosphere winds by means of drifting meteor trails. A continuously recording Doppler radar system operating on 27 mc is described and some typical records are analyzed. In Pt. 2 winds in the upper atmosphere have been deduced from the drifts of meteor trails by means of a continuously recording Doppler-radar system operating on 27 mc. Measurements of the average diurnal variations of the winds at known heights between 80-105 km have been obtained for each of the three months, Oct., Nov., and Dec., 1952. The winds are found to be essentially horizontal and analysis of the diurnal variations shows the presence of prevailing and periodic components of the wind. The 12 hr and 24 hr harmonic components represent anticlockwise rotation of the wind vectors; the 12 hr component is consistent with the phase of a semidiurnal tidal wind as deduced from barometric oscillations. While, at any time, the direction of the wind remains the same over the height range investigated, the mean velocity of the wind increases with height. (Met. Abst. 7.5-65)--Authors' abstract.

B-278 Roessler, E., Verfahren und Anlagen für meteorische Streuübertragung. (Methods and equipment for meteoric scatter transmissions.) Nachrichtentechnische Zeitschrift, 11(10): 497-503, Oct. 1958. 9 figs., table, 12 refs. Unchecked.

B-279 Roessler, E. (Berlin), Streuausbreitung von Funkwellen durch Meteorite. (Scatter propagation of radio waves by means of meteorites.) Umschau, Frankfurt a. M., 59(19):598, Oct. 1, 1959. DLC--Canadian engineers have developed a technique for utilizing meteorites, or the ionic traces produced by them, in the propagation of meter waves. Meteoritic scattering is substantially stronger than the ionospheric so that simpler direction antennas and capacities of less than 1 kw can suffice. The cosmic dust bodies, of which the meteorites are a part, continually penetrate into the upper layers of the atmosphere and ionize the air; approximately every second they produce transmission of short duration of about 0.1 second. Despite these short and intermittent transmissions a directional radio transmission can be carried on especially for telegraphy and television, even though meteoritic scattering is not always present. It is simply necessary that a sender (at station A) continually transmit carrier waves with a message until a receiver (at station B) reports their reception. For this return report there are used a sender of station B and a receiver at station A. The telegrams are fed in the usual manner as punched tape. The process of transmission by this method as carried out in Canada is outlined briefly. (Met. Abst. 11.12-162)--I.L.D.

B-280 Roessler, E., JANET, Übertragung mit meteorischer Streung. (Janet, radio transmission by meteoric scattering.) Elektronische Rundschau, 12(12):426-432, Dec. 1958. 8 figs., 8 refs., 6 eqs. DLC--Theoretical and practical explanation of this new mode of radio transmission, including some experimental results from Canada and U.S.A., are given. --W.N.

B-281 Roessler, E., Ultrakurzwellen-Übertragung durch Meteore. (Ultra-short wave transmissions by meteors.) Elektrotechnische Zeitschrift, 80(9):257-263, May 1, 1959. 9 figs., 20 refs. Unchecked.

B-282 Romell, D., Radio reflexions from a column of ionized gas. Nature, London, 167(4241):243, Feb. 10, 1951. fig., 3 refs. DLC--Measure the reflection of 30 centimeter radio waves from a mercury discharge tube of diameter 3.2 cm and length 80 cm. Directed wave at tube from distance of 1.5 meters with a Yagi aerial. Varied discharge current, and plotted reflected signal. Obtained a three humped curve. The maximum power reflected from the tube corresponded to about 80% of the power reflected from a half-wavelength wide metal strip. If the antenna was polarized parallel to the tube, instead of perpendicular, no reflection was observed. Test was an attempt to verify Herlofson's theory of plasma resonance in meteoric ionization columns. --L.A. Manning.

B-283 Royal Astronomical Society, (Symposium at Manchester, July 1949.) Observatory, London, 69:123, 1949. Unchecked.

B-284 Royal Astronomical Society, Geophysical discussion on winds in the upper atmosphere. Observatory, London, 76(890):17-21, Feb. 1956. DLC--Discussion concerning winds in ionosphere, meteor trails and ionization, F layer wind speeds and gradients, etc. (Met. Abst. 9.8-206)--M.R.

B-285 Royal Astronomical Society of Canada, Observer's handbook, Vol. 48, 1956. Ed. by C. A. Chant; Ruth J. Northcott and David Dunlap. Toronto, Univ. of Toronto Press, 1955. 83 p. figs., tables. DWB--Dates on meteor showers for 1956, angle of incidence and hourly rate, are given in table on p. 76 of this standard astronomical almanac. (Met. Abst. 8H-72)--M. R.

B-286 Russel, John A., Some perseid meteor spectra of the past decade. Sky and Telescope, 18(10):549-551, Aug. 1959. 8 figs. --A discussion of the spectra of some Perseid meteors observed by the author in the Sierras during summers starting from summer 1948. The observing site is 1000 ft above the valley floor of the Feather River near Blairsden, in the Plumas Forest district of northeastern California. The area is remarkably free from wind and the sky is very clear. Numerous photographs of different types of meteor spectra nicely illustrate the discussion. (Met. Abst. 11.12-144)--I. S.

B-287 Saxton, J. A. (D.S.I.R., Slough, Gt. Brit.), La physique de la diffusion ionospherique sur ondes metriques. (Physics of ionospheric scattering of meter waves.) L'Onde Electrique, Paris, 37(362):450-455, May 1957. 20 refs., 2 eqs. DLC--Possibilities of VHF communication (25-60 MHz) over distances of the order of 1000-2000 km by means of irregularities in the ionospheric E region have been established by recent research. The author reviews theoretical and experimental research work concerning the mode of propagation and concludes that the scatter signals may be due to either turbulence or meteors. While it is not possible, at present, to ascertain the prevalence of either of these factors, it appears probable that night signals are almost entirely due to meteoric scattering. (Met. Abst. 10.3-210)--G. T.

B-288 Shain, C. A. and Kerr, F. J., A note on factors affecting the interpretation of observations of transient echoes from the ionosphere. Journal of Atmospheric and Terrestrial Physics, 6(5): 280-281, May 1955. fig., 6 refs. DWB--Observed short-lived echoes on 100 kw 18.3 Mc/s radar direction vertically showed maxima at 5 h and 10 h. The maximum at 5 h is due to sporadic meteors. The maximum at 10 h is attributed to the low cosmic noise at this time; when observations are corrected for this the maximum disappears. (Met. Abst. 7.1-132)--C.E.P.B.

B-289 Sida, D. W. (Physics Dept., Univ. College, London), Atomic collisions in meteor trails. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 26-28. 5 refs., eqs.) DWB--

Two problems of meteor trails, the ionization of the meteor atoms and subsequent diffusion of the ions, are discussed in terms of the atomic theory of collisions at low energies. Calcium atoms are considered representing the meteor particles, and the cross section for momentum loss is calculated for direct impact with neon atoms by a statistical method. Further the diffusion coefficient for Ca + ions in atomic oxygen is considered and compared with radio echo decay observations. (Met. Abst. 8.1-362)--Author's abstract.

B-290 Sifford, B. M., Optimum transmission rate for low-power-meteor burst communication systems. Institute of Radio Engineers, Wescon Convention Record, Pt. 1:49-55, 1959. 5 figs., ref., 25 eqs. DLC--An optimum bandwidth criterion is presented based on an equal contribution to the total transmission time from "under-dense" and "over-dense" meteor trails. --From author's text.

B-291 Skellett, A. M., The effect of meteors on radio transmission through the Kennely-Heavyside layer. Physical Review, 37 (12):1668, June 15, 1931. DLC--This brief note gives evidence of the ionizing effect of meteors on short wave radio transmission at the height of the Kennely-Heavyside layer. A four point conclusion given is drawn from available data on meteor trains. --W. N.

B-292 Skellett, A. M., The ionizing effect of meteors in relation to radio propagation. Institute of Radio Engineers, Proceedings, 20(12):1933-1940, Dec. 1932. fig., table, 18 refs. DLC--Draws these conclusions: (1) Meteors expend the larger part of their energy in KH regions controlling long distance radio waves. (2) This energy ionizes the gases around the meteor path. (3) Ionization extends km-wise from the path, lasting for some minutes after passage. (4) Meteor trains are produced in lower KH layer only. A table of ionizing agents and their values in ergs cm^{-2} is given. The effect of meteors on radio propagation is discussed along with turbulence caused by meteors. --Based on author's abstract.

B-293 Skellett, A. M., The ionizing effect of meteors. Institute of Radio Engineers, Proceedings, 23(2):132-149, Feb. 1935. 5 figs., table, 35 refs. and foot notes. DLC--Deals with search for evidence of meteoric ionization and physical data and search for evidence of ionization from radio data. --From author's text.

B-294 Skellett, A. M., Meteoric ionization in the E region of the ionosphere. Nature, London, 161(3567):472, March 12, 1948. 4 refs. --

Wishes to emphasize importance of meteoric ionization in E-layer, as suggested by Eckersley. States that on the basis of telescopic observation it has been estimated that 109 meteors of 8th magnitude or better enter earth's atmosphere per day. This is 180 for 500 km diameter in 40 seconds, or 6 times as many meteors as Eckersley observed clouds. States even short waves may be reflected. --L. A. Manning.

B-295 Stewart, J. Q.; Ference, M.; Slattery, J. J. and Zahl, A. A., Radar observations of the draconids. Sky and Telescope, 6 (5):3-5, 1947. --Simultaneous observations with 21 radars at 100, 600, 1200, 3000 and 10,000 Mc/s were conducted at White Sands Proving Ground, during 2030 and 2300 EST, Oct. 9, 1946. Only the SCR-270 radar at 100 Mc/s gave excellent results. Of the originally determined 115 (later corrected to 296), 18 indications lasted from 3-27 sec. Against the belief that ionization is produced by kinetic energy of a meteor it is speculated whether or not the meteor merely mechanically stirs up already existing ions. --W. N.

B-296 Van Valkenburg, M. E., The two-helix method for polarization measurements of meteoric radio echoes. Journal of Geophysical Research, 59(3):359-364, Sept. 1954. 5 figs., 2 tables, 7 refs., 8 eqs. DLC--A method employing two helical beam antennas is described for measuring polarization effect of radio echoes from non-shower meteors of unknown trail orientation. Results obtained by the method are in good agreement with theoretical values and with measurements made on shower meteors by another method by Clegg and Closs. --Author's abstract.

B-297 van Woerden, H. (Leiden Observatory), Meteoorwaarnemingen in het Internationaal Geofysisch Jaar. (Meteor observations in the International Geophysical Year.) De Meteoor, Utrecht, 13(3/4):22-28, June/Aug. 1957. --Plans for meteor observation during the IGY are discussed. As compared to MILLMAN's program published in Sky and Telescope, the Dutch emphasis is on carefully calibrated work by individual observers rather than on group observations. Fields of view will be strictly limited and not more than 40° in radius. Attention is given to the statistics of meteor pairs separated by only a few seconds of time. Data recorded will include time of appearance, magnitude, radiant (shower), presence and duration of luminous trail. Limiting magnitudes are determined by star counts in small areas of sky. (Met. Abst. 11.2-38)--A. V.

B-298 Verniani, F., Deceleration of meteors during their passage through the earth's atmosphere. Florence. Univ., Contract AF 61(052)-227, Technical Note, No. 2, June 1959. 6 p. Unchecked. --

The theory of the deceleration of meteors is computed as a function of the characteristic quantities of evaporation, in particular, of velocity. Results show that for over 3/4 of all meteors, the deceleration increases until the end of evaporation. At the point of maximum rate of evaporation, the deceleration, as a first approximation, may be assumed the same for all meteors. (Met. Abst. 11.10-105)--Author's abstract.

B-299 Verniani, F., On the velocity of meteors during their evaporation. Florence. Univ., Contract AF 61(052)-227, Technical Note, No. 1, June 1959. 8 p. incl. tables. Unchecked. --Herlofson's equations for meteoric evaporation indicate that part of the meteor cannot evaporate completely because of their excessive loss of speed. Results show that the flight of all meteors is considerably retarded during the entire process of evaporation. (Met. Abst. 11.10-106)--Author's abstract.

B-300 Villard, O. G., Jr., Meteor detection by amateur radio. QST Magazine, 31(7):13-18, July 1947. 3 figs., table, 13 refs.--The whistler and the burst reflection of radio signals from meteor trails are explained and how radio amateurs should record meteoric radio echoes.--W. N.

B-301 Villard, O. G., Jr., Communication by meteor reflection. Research Reviews, (ONR):19-27, Sept. 1953. Unchecked.

B-302 Villard, O. G., Jr.; Peterson, A. M.; Manning, L. A. and Eshleman, V. R., Extended range high frequency radio communication at relatively low power, by means of overlapping oblique reflections from meteor ionization trails. Science, 117(3049):638-639, June 5, 1953. 5 refs. DLC--Short account of radio wave propagation experiments over 800-1000 mi, suggesting that reflections from meteor trails can be successfully utilized for radio transmission on one frequency throughout the 24 hours (see ref. no. 303 . (Met. Abst. 6.1-331)--A. A.

B-303 Villard, O. G., Jr.; Peterson, A. M. and Manning, L. A. (Radio Propagation Lab., Stanford Univ., Calif.), Extended range radio transmission by oblique reflection from meteoric ionization. Journal of Geophysical Research, 58(1):83-93, March 1953. 3 figs., table, 7 refs. DWB--It has been found that radio communication between relatively low power stations operating at 14 Mc and separated by distance of roughly 1200 km may be maintained at times when no layer transmission to any point on the earth's surface can be demonstrated to be present. The signal obtained is subject to considerable fading, but some signal is nearly always detectable. The contribution of overlapping oblique incidence meteor reflections to the observed signal is considered in the light of some preliminary theoretical and experimental findings. It is clearly important to assess the meteoric contribution with care, since the possibility that meteoric reflections alone could account for the signal does not seem unreasonable. Suggestions for further investigation are given. (Met. Abst. 5.5-225)--Authors' abstract.

B-304 Villard, O. G., Jr. and Peterson, A. M., Meteor Scatter: a newly discovered means for extended range communication in the 15- and 20-meter bands. QST Magazine, 37(4):11-15, 124, 126, April 1953. 5 figs., 7 refs. DLC--Increase of duration of the meteoric echo as a function of obliquity is well exemplified here in the case of a transmission path of 800 km using 15-20 m λ. --W. N.

B-305 Villard, O. G., Jr.; Eshleman, V. R.; Manning, L. A. and Peterson, A. M. (all, Radio Propagation Lab., Stanford Univ., Stanford, Calif.), Role of meteors in extended range VHF propagation. Institute of Radio Engineers, N. Y., Proceedings, 43(10):1473-1480, Oct. 1955. 8 figs., table, 15 foot-refs., 2 eqs. DLC--The main factors influencing the propagation of continuous radio signals by reflection from meteoric ionization trails are reviewed and summarized. A procedure is given for calculating the system parameters required to maintain the signal received over a given path above the cosmic background noise level for 95% of the time. It is pointed out that the variation of signal level with frequency and path length measured for certain "ionospheric forward scatter" circuits agrees well with calculations based on the assumption that the propagation is entirely by scattering from meteor ion trails. It is suggested that ionospheric scatter is predominantly meteoric at night in the lower latitudes. To the extent that this is true, the minimum performance level of existing circuits could be improved by use of antennas designed to maximize the meteoric component of the signal. Present designs actually tend to discriminate against meteors. (Met. Abst. 8H-116)--Authors' abstract.

B-306 Villard, O. G., Jr.; Peterson, A. M.; Manning, L. A. and Eshleman, V. R. (all, Radio Propagation Lab., Stanford Univ.), Some properties of oblique radio reflections from meteor ionization trails. Journal of Geophysical Research, Wash., D. C., 61(2, Pt. 1):233-249, June 1956. 8 figs., 5 tables, 9 refs., 3 eqs. DLC--Certain characteristics of radio signals, propagated by reflection from meteor ionization trails from a low power continuous wave transmitter 960 km distant, were studied at radio frequencies of 23.2, 46.4, and 92.8 Mc. In particular, the percent of the total time that meteor reflections were detectable at each frequency is presented, and shown to be in qualitative agreement with theoretical expectations. Simultaneous recordings were also made of signals from a second remote transmitter operated at 23.1, 46.2, and 92.4 Mc, and located at various distances along, and at right angles to, the propagation path. From the percent time that signals received from the second transmitter were coincident with those from the first, it is concluded that reradiation from the numerous, low density trails is highly directional, and that the fading, long enduring echoes from the relatively infrequent, high density trails are considerably less directional. When the transmitters were spaced in a direction perpendicular to the propagation path, the signal coincidence decreased much more rapidly with transmitter spacing than when the transmitters were spaced along the propagation path. (Met. Abst. 8H-89)--Authors' abstract.

B-307 Vincent, W. R.; Wolfram, R. T.; Sifford, B. M.; Jaye, W.E. and Peterson, A. M., Analysis of oblique path meteor propagation data from the communications viewpoint. Institute of Radio Engineers, Proceedings, 45(12):1701-1707, Dec. 1957. fig. 21, 8 refs. DLC--The characteristics of signals reflected from meteor trails have been extensively measured and analyzed to determine their usefulness in communications. The random nature of meteor sizes, radiants, velocities, time of striking the upper atmosphere, showers, etc., make precise determination of the various desirable propagation parameters difficult; however, gross characteristics such as duration, interval between usable signals, antenna direction effects, diurnal rate and duty cycle, and rate of signal decay are presented in a form usable to the design of communications circuits. (Met. Abst. 10.1-340)--Authors' abstract.

B-308 Vincent, Wilbur R.; Wolfram, Russel T.; Sifford, Bruce M.; Jaye, Walter E. and Peterson, Allen M., A meteor burst system for extended range VHF communications. Pt. 1: propagation characteristics. Institute of Radio Engineers, Wescon Convention Record, 1(1):263-272, 1957. 22 figs. Pt. B: Equipment design and operation. Ibid., p. 273-281. 9 figs., ref. DLC--The purpose of this report is to summarize a series of measurements undertaken at Stanford Research Institute in the field of radio signal propagation supported by ionized meteor trails. The information has been developed in a way to make it usable to the designer of communication systems. The data presented here summarize approximately two years' findings and provide a basis for determining design parameters applicable to the communications system described in part B of this paper. --Authors' abstract.

B-309 Vincent, W. R.; Wolfram, R.T.; Sifford, B.M.; Jaye, W.E. and Peterson, A.M., A meteor burst system for extending range VHF communications. Institute of Radio Engineers, Proceedings, 45(12):1693-1700, Dec. 1957. 9 figs. (incl. photos), ref. DLC--A low-power burst communication system has been designed and tested, utilizing the intermittent propagation path provided by ionized meteor trails. A test circuit has been installed between Bozeman, Mont. (Montana State College), and Palo Alto, Calif. Details of the burst control techniques and storage devices used to handle the intermittent information flow are discussed, along with the overall system design. (Met. Abst. 10.1-339)--Authors' abstract.

B-310 Vincent, W. R. and Smith, Frances H., Summary of literature pertaining to radio studies of meteors and meteor trails. Stanford Research Institute, Menlo Park, Calif., Contract AF 19(604)-1517, Jan. 1960. 387 p. --Stanford University has carried out studies on the basic physics of meteors and meteor trails for 15 years, resulting in the compilation of this comprehensive work from all available articles, papers, reports, books and other pertinent literature in English. Abstracts and discussions are included. Soviet and Eastern European papers are listed separately without abstracts. Information acquired from these studies has been applied in the Stanford-Bozeman meteor burst communication system. (Met. Abst. 11.10-110)--N. N.

B-311 Vogan, E. L. and Campbell, L. L., Meteor signal rates observed in forward-scatter. Canadian Journal of Physics, Ottawa, 35(10):1176-1189, Oct. 1957. 9 figs., 22 refs., eqs. DWB, DLC--Diurnal and seasonal variations in meteor signal rate observed during a 15 month period over a forward scatter path situated in eastern Canada are discussed. Measurements were made at a frequency of 49.98 Mc/s. The data show a large spread from hour to hour and day to day with the greatest signal rate being observed during the summer months. The influence of ionospheric absorption on the signal rate observed during the morning hours is considered, and it is concluded that the presence of a small amount of attenuation can modify appreciably the form of the diurnal variation. (Met. Abst. 9.7-265)--Author's abstract.

B-312 Volmer, Pierre, Vérification à l'aide d'un radar de l'altitude de disparition des trainées météoriques dont le radiant est connu. (Radar observation of the height of extinction of meteor trails having a known radiant.) Academie des Sciences, Paris, Comptes Rendus, 237(18):1065-1067, Nov. 2, 1953. 2 figs., 4 refs. DWB--Explaining the geometry of determining the theoretical distance of the nearest radar echoes from meteor trails, which can be observed with various radiants and heights of extinction, and comparing the results with distances of meteor trails actually observed (Aug. 11-13, 1952) the author places the average height of meteor trail extinction in the neighborhood of 85 km. (Met. Abst. 5.9-301)--G.T.

B-313 Watson, Fletcher G., Meteors, the stony and metallic particles that enter the earth's atmosphere can now be perceived day or night and rain or shine by radio echo. Scientific American, 184(6):23-28, June 1951. photos, diagr. DLC--Two techniques of detecting meteors, one based on radar echoes and the other on radio whistles, are described and some of the results of their application mentioned. Attention is given to the possibility of a more detailed understanding of the composition and structure of the ionosphere, and particularly the E layer, from evaluation of meteor ion trail measurements. Photos of radio echo recordings, meteor trails and a spectrum are presented. Analyzing large amount of available data is declared to be immediate major problem of research. (Met. Abst. 3.10-105)--G.T.

B-314 Watson, Fletcher Guaard, Between the planets. Rev. ed. Cambridge, Mass., Harvard Univ. Press, 1956. 188 p. 53 figs., 67 photos, 31 tables. DWB. Review by P. Graystone in Meteorological Magazine, London, 86(1017):92-93, March 1957. DWB--A small volume covering systematically the latest information on interplanetary conditions, comets, meteor showers, meteorites, radio and radar observations of meteors, meteor craters, explosions, trails, ionization, etc. The zodiacal light, interplanetary dust, the ionosphere and case histories of great meteor falls are vividly described and illustrated. A good amount of quantitative data is included, but little theory or technical information. (Met. Abst. 8.7-13)--M.R.

B-315 Weaver, D. K., Jr., Applied research on meteor burst communications. Stanford Research Institute, Scientific Report, No. 2, May 1956. Unchecked.

B-316 Weiss, A. A. (Physics Dept., Adelaide Univ.), Diffusion coefficients from the rate of decay of meteor trails. Australian Journal of Physics, Melbourne, 8(2):279-288, June 1955. 6 figs., table, 15 refs., 5 eqs. DWB, DLC--The effective diffusion coefficient for a meteor trail is calculated from the theory of ambipolar diffusion and the physical constants of the upper atmosphere. The absolute value of the diffusion coefficient so calculated, and also its gradient with height, are confirmed by measurement of the rates of decay of a large number of meteor echoes of known heights. The individual values show considerable scatter, most of which is attributed to a regular diurnal variation in the value of the diffusion coefficient. Amplitude fluctuations in persistent echoes are also briefly discussed. (Met. Abst. 8.4-319)--Author's abstract.

B-317 Weiss, A. A. (Dept. of Physics, Univ. of Adelaide), Radio echo observations of meteors in the Southern Hemisphere. Australian Journal of Physics, Melbourne, 8(1):148-166, March 1955. 2 tables, 12 figs., 21 refs. DLC. Also in: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. --A year of measurements of wind in the meteor region have been made at Adelaide, South Australia with equipment reported by ROBERTSON, LIDDY and ELFORD in 1953. Seasonal changes are evident at 80-100 km; the wind reverses direction from east to west at 70 km in summer and at 100 km in winter, while in spring it is E. 15 m/sec and in autumn W, 35 m/sec. A 24 hr period is found in all months, but the semidiurnal component is irregular in amplitude and phase. The radiants and activities of six major meteor showers (Geminids, day-time Arietids, ζ -Perseids, δ -Aquarids, Corona Australids, Orionids) have been measured by methods which are described, and the mass distributions in three of these showers are discussed. Seasonal and diurnal variations in the background activity of sporadic meteors are examined in relation to the radiation patterns of the aerial systems. Height distributions for meteors of three showers (Geminids, day-time Arietids, ζ -Perseids) are given. Diurnal variations in the height distribution of sporadic meteors do not conform to those expected from the motion of the apex of the earth's way. (Met. Abst. 8H-74)--M. R. and Author's abstract.

B-318 Weiss, A. A. (Div. of Radiophysics, C. S. I. R. O., Dept. of Physics, Univ. of Adelaide), The distribution of the orbits of sporadic meteors. Australian Journal of Physics, Melbourne, 10(1):77-102, March 1957. 14 figs., 5 refs., 11 eqs. DLC--

The directions of the reflection points of sporadic meteor trails for March and Sept. 1953, and the hourly echo rates of sporadic meteors obtained from the Adelaide radio survey of meteor activity over 1952-1956 are analyzed. Diurnal and annual variations in the sporadic echo rate are predicted from contemporary theory on the reflection of radio waves from meteor trails for several model distributions. A sporadic distribution is derived which consists of a concentration of direct short-period orbits to the plane of the ecliptic superimposed upon a more uniform distribution of near parabolic orbits. This distribution is consistent with the results of radar, visual, and telescopic surveys in the Northern Hemisphere. The density of sporadic meteors round the earth's orbit is also derived. (Met. Abst. 8H-97)--Author's abstract.

B-319 Weiss, A. A., The incidence of meteor particles upon the earth. Australian Journal of Physics, 10(3):397-411, Sept. 1957. 4 figs., 4 tables, 11 refs., 9 eqs. DLC--The present paper, based on data of two preceding papers, deals with the influx of meteor particles over the whole surface of the earth and with their density in space. The observations were conducted at Adelaide with 27 Mc/s CW equipment. --From author's text.

B-320 Weiss, A. A., Meteor activity in the southern hemisphere. Australian Journal of Physics, 10(2):299-309, June 1957. 5 figs., 2 tables, 14 refs. DLC--Detections by radio equipment at Adelaide 1952-56, are reported. Results are compared with those of similar observations from the northern hemisphere. --W. N.

B-321 Weiss, A. A. (C.S.I.R.O., Dept. Physics, Univ. Adelaide), Approximations for the electron density in meteor trails. Australian Journal of Physics, Melbourne, 11(4):591-594, Dec. 1958. fig., table, 6 refs., 6 eqs. DWB, DLC--First, Herlofson's equation and his widely used approximations are discussed in relation to fast meteors, but with serious doubt of validity for slow meteors. Author goes on to demonstrate more realistic description of conditions near the point of maximum electron density by his own improved sets of approximations, extent of which is shown in a table for comparison. --W. N.

B-322 Weiss, A. A. (Div. of Radiophysics, C.S.I.R.O., at Dept. of Physics, Univ. of Adelaide), The 1956 Phoenicid meteor shower. Australian Journal of Physics, Melbourne, 11(1): 113-117, March 1958. fig., 3 tables, 9 refs., 3 eqs. DLC--From radio observation of this shower at Adelaide the radiant coordinates are estimated to be 15 + 2, −55 + 3.

The radio record was obtained when the earth was some 6 hrs from the center of the stream. The radio rate of 30/hr measured on an equipment of high sensitivity is much lower than expected from the visual rates of from 20 to 100/hr reported from 1 to 9 hrs later. Echo duration and amplitude are smaller than would be expected from the visual brightness of these meteors. The low radio rate and lack of bright radio meteors could be due to observation on the fringe of the stream or to low ionizing efficiency of slow meteors. (Met. Abst. 10.6-126)--Author's abstract.

B-323 Weiss, A. A. (Dept. Physics, Univ. of Adelaide), Elevation, height, and electron density of echoing points of meteor trails. Australian Journal of Physics, Melbourne, 12(1): 65-76, March 1959. 7 figs., table, 9 refs., 6 eqs. DLC--Continuous and systematic operation of a C. W. equipment which measures simultaneously several characteristics of meteor echoes, including the location in space of the reflection point, provides the basic material for an examination of the geometry of detection of meteor trails by radio equipment and of the processes underlying selection of echoes for measurements of different kinds. At least 60 percent of all echoes are distorted in some degree, presumably by atmospheric turbulence or by non-specular reflection. This and selection in height due to diffusion of the trail are the two most important selection processes. The distribution of the echoing points of sporadic meteors, in zenith angle and in height, is compared with theoretical expectation. Height distributions found for Arietid and ζ -Perseid meteors agree with other measurements. The height distribution for the Geminid shower is unexpectedly narrow, a fact for which no satisfactory explanation can be advanced. Distributions of electron line densities at reflection points agree qualitatively with known mass distributions and trail shapes. (Met. Abst. 11.10-116)--Author's abstract.

B-324 Weiss, A. A. (Univ. of Adelaide, Australia), The limitations of narrow beam radio equipments in the detection of weak meteor showers. Journal of Atmospheric and Terrestrial Physics, London, 14(1/2):19-30, April 1959. 6 figs., 2 tables, 11 refs., 2 eqs. DLC--At the echo rates practicable for a routine survey of meteor activity using a narrow beam radio equipment, it is shown that the chief limitation to the recognition of weak shower activity is the fluctuations in the rate of detection of background (sporadic) meteors. Examination of echo rates obtained with the Adelaide 67 Mc/s equipment for Dec. 1956 and Jan. 1957 confirms that over short intervals of time the background fluctuations are random. A significance test, intended for use as a search method for weak shower activity and non-random fluctuations in the background activity, is then developed. This test, based on echo rates, is applied to the data for Dec. 1956 and Jan. 1957. (Met. Abst. 11.10-115)--Author's abstract.

B-325 Weiss, A. A. (Dept. of Radio Physics, Univ. Adelaide, Australia), Radio echo observations of the Geminid meteor stream. Australian Journal of Physics, Melbourne, 12(4): 315-319, Dec. 1959. 3 figs., 2 tables, 8 refs. DLC--Measurements of radiant coordinates and echo rates from 1952 to 1957 are summarized. A mean radiant of $\alpha = 113.4^{\circ}$, $\delta = 31.4^{\circ}$ at solar longitude, $\odot = 260.2^{\circ}$, a small radiant area, and a markedly asymmetrical distribution of meteors across the stream, with a maximum echo rate at $\odot = 260.8^{\circ}$, all agree with northern hemisphere radio echo observations made between 1949 and 1954. (Met. Abst. 11.10-114)--Author's abstract.

B-326 Weiss, A. A., The temporal variation of the heights of reflection points of meteor trails. Australian Journal of Physics, Melbourne, 12(2):116-126, June 1959. 7 figs., 4 tables, 8 refs., 2 eqs. Unchecked.

B-327 Weiss, A. A. (Dept. Physics, Univ. of Adelaide), Theory of the radio echo meteor height distribution in a non-isothermal atmosphere. Australian Journal of Physics, Melbourne, 12(1):54-64, March 1959. 5 figs., 9 refs., 21 eqs. DLC--The theory of the distribution in height of the echoing points of shower meteors and of sporadic meteors belonging to a homogeneous velocity group, is extended to the case of a model atmosphere in which the scale height is a linear function of height. The mean and the r.m.s. deviation from the mean of the height distribution in this atmosphere are obtained in terms of tabulated functions, and the dependence of these parameters upon the scale height gradient is evaluated. Neither parameter varies strongly with the scale height gradient unless the incident meteors include a large proportion of massive particles. Experimental cut-off and the approximations made in the formulation of the theory limit the accuracy with which atmospheric scale height and density can be determined from observed heights of sporadic meteors. (Met. Abst. 11.8-68)--Author's abstract.

B-328 Wells, H. W. (Dept. of Terrestrial Magnetism, Carnegie Inst. of Washington), Radio interferometer technique applied to measurement of meteor velocities. Journal of Geophysical Research, 58(2):284-286, June 1953. 2 figs., foot-refs. DWB --A technique is outlined for measuring meteor velocities and path length by the interferometer method, using continuous wave rather than pulsed systems. Signals are sent from Cedar Rapids, Iowa and received at Washington, D. C., on a frequency of 49.8 Mc. When one antenna was used, no interference pattern was evident on the polar diagram, but when two antennas were connected a characteristic Z occurred on the record of one of the lobes as a meteor passed over a null-point and sometimes 2 successive Z's were noted. (Met. Abst. 8H-38)--M. R.

B-329 Whipple, Fred L., The theory of micrometeorites. Pt. 1: In an isothermal atmosphere. National Academy of Science, Proceedings, 36(12):687-695, Dec. 1950. 8 refs., 22 eqs. --Landsberg's finding of particles, apparently associated with the Giacobinid shower 1946, suggested that these micrometeorites had traversed the atmosphere intact. Hence, the purpose of this paper is "to investigate the process whereby temperature radiation can dissipate the energy gained by encounters with atmospheric molecules sufficiently rapid to permit finite meteoric particles to be stopped without melting".--From author's text.

B-330 Whipple, Fred L., Meteors as probes of the upper atmosphere. (In: Compendium of Meteorology. Boston, American Meteorological Society, 1951. p. 356-365. 3 figs., table, 95 refs., 7 eqs.) MH-BH--A thorough exposition of every possible aspect of meteor study which could apply to meteorology. The article begins with a history of such study, origin of meteoric bodies, definition of terms and limits of velocity of meteor fall, chemical composition as determined by spectra, indicated temperatures, fragmentation in atmosphere and flaring due to crumbling. Visual methods of observing height by triangulation were begun in 1798. Later Lindemann and Dobson used data to determine temperature, density, high level wind draft and turbulence. Height varies from night to day and lower daytime levels are attended by lower average wind speeds. Photographic studies made since 1893 at Yale and more recently at Harvard, are used to develop theories which enable computation of air density

$$\rho_0 = -\frac{2^{1/3}\, V'_0}{V A r_0^{1/3} V^2}\left[\int_{t_0}^{\infty} \left(I'/V^3\right) dt\right]^{1/3}$$

when mass, rate of mass loss, luminosity, acceleration and drag coefficient are first calculated. Errors arise from assumption that drag coefficient is constant with respect to velocity and density. These errors will be greatest at great altitudes where is large. Comparison with NACA standard atmosphere shows marked similarity (although both curves are anchored to same base at 50-60 km, and NACA atmosphere derives in part from same data). Residuals show strong seasonal correlation and correlation with surface temperatures but not with fronts, declination of sun or sunspot number. Advances will come from modern radio meteor observation techniques, although there are limitations even to this method. Increased observational accuracy, laboratory studies on the drag and heat transfer coefficients, and study of the physical and chemical nature of meteorites will also contribute to progress. Difference between two methods of radio observation; the pulse packet and the continuous transmission (Doppler) method is explained. (Met. Abst. 4.1-15)--M. R.

B-331 Whipple, Fred L. (Harvard Col. Obs.), Exploration of the upper atmosphere by meteoritic techniques. Advances in Geophysics, N. Y., 1:119-154, 1952. 7 figs., 4 tables, 74 refs. DLC--A comprehensive review of the entire field of meteor observation and the use of meteors in upper atmosphere research. Meteors, meteorites and meteroids; meteoritic dust or micrometeorites, meteor trails and meteor trains, meteor showers, etc., are defined or distinguished one from another. Visual photographic, spectral, radio and micrometeoritic techniques in observation and results therefrom, are discussed in separate paragraphs. Use of this data and theories pertinent thereto, in determining the density, temperature and pressure of the stratosphere and, finally, the estimation of winds at the 40 to 110 km levels from meteor train observations, and recently from radio reflection (Body-Doppler) measurements involving ionization, persisting after the meteor has been consumed, are summarized. (Met. Abst. 4.9-10)--M. R.

B-332 Whipple, Fred L., Meteoritic phenomena and meteorites. (In: U. S. School of Aviation Medicine, Randolph Field, Texas, Physics and medicine of the upper atmosphere. Albuquerque, 1952. p. 137-170. figs., tables, 51 refs., eqs.) DLC--This paper is concerned with the interaction of meteorites and meteors with the upper atmosphere by radiation, by electrons producing radar reflections and by night sky radiation, all of which measure the physical state of the upper atmosphere, and with the interaction of meteoritic particles with aircraft or occupants of aircraft. The following topics are covered: meteorite craters and the chemical and physical properties of meteorites, the brightness velocities and orbits of meteors, micrometeorites, interplanetary gas; the basic theory underlying the methods for determining upper atmospheric densities from photographic observations of meteors, upper atmospheric densities obtained by these methods; the meteoritic penetration of high altitude vehicles including chances of meteoritic encounter, the masses and intensities of meteoroids, meteoritic penetration and safety precautions against meteoritic penetration. (Met. Abst. 4. 7-213)--I. L. D.

B-333 Whipple, Fred L. (Harvard College Obs.), Evidence for winds in the outer atmosphere. National Academy of Sciences, Wash., D. C., Proceedings, 40(10):966-972, Oct. 1954. 2 figs., 27 refs. DWB--An integrated account of the numerous methods of estimating winds above the "balloon level". Some of these are: meteor trains (visual and radio tracking and Doppler techniques), noctilucent clouds, night glow, aurora, sound propagation, ionospheric motions, high altitude rockets, etc. Hope is expressed that the IGY will increase our knowledge or understanding of these motions on a global scale. (Met. Abst. 8H-107)--M. R.

B-334 Whipple, Fred L. and Hughes, Robert F. (both, Harvard College Obs.), On the velocities and orbits of meteors, fireballs, and meteorites. (In: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 149-156. 3 figs., 2 tables, 13 refs., eq.) DWB--Extra-terrestrial material falling upon the earth can be arranged according to mass in the following sequence: radio meteors, visual meteors, photographic meteors, fainter fireballs, great fireballs, detonating bolides, and meteorite falls. Precise velocities have been measured only for radio meteors, meteors of cometary streams, and photographic meteors. These velocities and the elongation of the apparent radiants from the apex of the earth's motion indicate that in the sequence beginning with photographic meteors, the distribution of geocentric velocities shifts progressively toward the low-velocity limit. That is, the orbits become less inclined, smaller, and more circular. The relative cometary contribution is probably a maximum for the smallest masses and decreases steadily to zero for meteorite falls. Meteorites move largely in small, low eccentricity orbits of small inclination. We find that their root-mean-square atmospheric velocity is about 17 km/sec. (Met. Abst. 8. 5-322)--Authors' abstract.

B-335 Whipple, Fred L. (Harvard Coll. Obs.), The physical theory of meteors, Pt. 7, On meteor luminosity and ionization. Astrophysical Journal, Chicago, 121(1):241-249, Jan. 1955. 4 figs., 5 tables, 21 refs., 2 eqs. Summary in: Kaiser, T. R. (ed.), Meteors. London, Pergamon Press, 1955. p. 16-17. DWB--

The relative frequencies of occurrence of radio and bright photographic meteors suggest either (a) that the ratio of meteoric ionization to luminosity varies as $(velocity)^2$ or (b) that there exists a surprising dependence of particle size upon orbital characteristics. The writer prefers the first alternative, which leads to about a $(velocity)^5$ law for the ionizing efficiency per gram. An order of magnitude deficiency in radio meteors at velocities above 60 km/sec may well arise from a suppression of radio-velocity measures for faint meteors above an altitude of about 110 km by rapid diffusion of the ion column. Meteor ionization, like a persistent meteor train, probably also decays extremely rapidly below about 82 km. The combined effects of rapid electron diffusion at high altitude and decay at lower altitudes would reduce the slope of the mean height-velocity curve for radio meteors as compared to photographic meteors. In this manner, conflicting data concerning the efficiencies of ionization versus luminosity for meteors may be reconciled. (Met. Abst. 8H-77)--Author's abstract.

B-336 Wirth, H. J., Preliminary observations of forward scattering of electromagnetic waves by meteor trails. U. S. Navy Electronics Laboratory, San Diego, Calif., Research Report, No. 690, May 9, 1956. 8 p. 11 figs., table, 3 foot-refs. DWB--This report covers a statistical analysis of preliminary data on meteoric ionization scatter obtained with very-high-frequency amplitude modulated transmissions over a California path from Palo Alto to San Diego. In general, the data agreed with theoretical predictions. (Met. Abst. 8H-90)--Author's abstract.

B-337 Wirth, H. J. and Keary, T. J., The duty cycle associated with forward scattered echoes from meteor trails. Institute of Radio Engineers, National Convention Records, :127-132, March 1958. Unchecked.

B-338 Wisbar, Herward, Wellenstreuung und meteoride Einflüsse auf kurzen und den benachbarten ultrakurzen Wellen. (Wave distribution and meteorite effects on short and very short waves.) Archiv der Elektrischen Übertragung, Stuttgart, 10(8):343-352, Aug. 1956. 12 figs., table, 16 refs. German and English summaries p. 343. DLC--A long technical discussion of scatter-waves due to residual ionization, at medium (500-2000 km) and very great (4000-11, 000 km) distances, probably due to meteor ionization. The influence of grazing frequencies and results of observations in 40-70 m/Hz range, long enduring meteor echoes, atmospheric and tropospheric influences at 40-70 m/Hz, effects of an ionospheric disturbance or auroral storm, and commercial applications for radio, telegraph and telephone circuits, are discussed and illustrated with schematic diagrams and synoptic charts. (Met. Abst. 8H-91)--M. R.

B-339 Wolfram, R. and Sifford, B. M., A long range VHF meteor burst communication system. Stanford Research Institute, AD 149-805, Sept., 1957. Unchecked.

B-340 Bombardment of the earth by meteors. Nature, London, 179 (4551):121-124, Jan. 19, 1957. table. DWB--Account of Geophysical Discussion at Royal Astronomical Society, Nov. 16, 1956. M. H. HEY, opening, described contribution of meteors and meteorites to earth's mass, their chemistry and structure, and the impact of a big meteorite with the earth. T. GOLD also discussed mass contribution and craters on earth and moon, and possible instability patterns resulting from very large meteorites. J. G. DAVIES (of Jodrell Bank) and E. J. OPIK described magnitudes of meteors (sporadic and showers) based on radio observations. (Met. Abst. 8H-92)--C. E. P. B.

B-341 Ionosphere winds charted from meteor echoes. Electronics, Albany, N. Y., 23(10):120, 122, 1950.--Evidence, through utilization of the Doppler effect, for the existence of ionospheric winds of 88-130 km/h. (Met. Abst. 4F-61)--W. N.

B-342 Joint Commission on High Altitude Research Stations. International Union of Geodesy and Geophysics, Bulletin d'Information, 2(2):380-383, April 1953. 3 tables. DWB--The problem of World Days is discussed in relation to the desirability of having them at times of meteor showers. Coordination with the WMO and the Association of Meteorology of the I. U. G. G. is also indicated. (Met. Abst. 8H-30)--M. R.

B-343 Measurement of V. H. F. bursts. Electronics, 18:105, Jan. 1945. fig. --Confirmation of bursts as produced by ionization of passing meteors was obtained when a visual meteor train sustained the increased signal for about ten seconds. --W. N.

B-344 Messages by meteor trails. Science, Wash., D. C., 124 (3215):258-259, Aug. 10, 1956. DLC--Messages may be transmitted over long distances by using the frequently observed trails of single meteors in the ionosphere (about 60 mi high), according to P. A. FORSYTH of the Radio Physics Laboratory near Ottawa. The work of Project 'JANET" which has just been declassified, is described. Signals have been transmitted for up to 1000 mi using frequencies in the TV range. Messages are stored in an "electronic brain" which releases them whenever a meteor trail comes between the two communicating points, but at such a high speed that they must be stored electronically and released slowly for teletype printing. This method opens up a whole new band for transmission, and is free from interference by aurora. (Met. Abst. 8H-84)--M. R.

B-345 Meteors. Mediterranean Sea. Marine Observer, 23(162): 206, Oct. 1953. fig. DWB--Sketches of trail of meteor on Nov. 15, 1952, showing remarkable deformation during 8 minutes. (Met. Abst. 6. 3-347)--C. E. P. B.

B-346 Strange behavior of F. M. signals recorded. Electronics, 17:256, 262, July 1944. DLC--Brief description of the FM radio interference as observed on four UHF radio stations at Laurel, Maryland since Feb. 1943 when FCC began investigation into characteristics of the phenomenon and its cause. The bursts have been received over 1400 miles and are of ionospheric origin. --W. N.

B-347 V-H-F bursts analyzed by FCC engineers. Communications, 24(7):61, 88, July 1944. DLC--Long distance bursts, of very short duration, but varying in amplitude from lowest measurable level to excess of requirements for FM radio service, are reported on in relation to interference in FM radio. The FCC is continuing their observations in order to explain this puzzling phenomenon. --W. N.

SUPPLEMENTARY MATERIAL

B-348 Anfimov, N. A. (Moscow Physicotechnical Inst.), Some regularities in the motion of meteoric bodies in the atmosphere. Soviet Astronomy AJ, New York, 3(1):139-142, Jan./Feb. 1959. 2 figs., 8 refs., numerous eqs. DLC. Transl. of original Russian in Astronomicheskii Zhurnal, Moscow, 36(1):137-140, Jan./Feb. 1959. DLC--Analysis is made of the relation between dimensionless quantities in the study of the process of heat transfer in meteor-air encounters. An empirical formula is derived for the coefficient $0 = \frac{\lambda}{2 r \delta}$. A number of conclusions are arrived at on the relation between melting and evaporation in the ablation of meteoric bodies. (Met. Abst. 11L-149)--Author's abstract.

B-349 Davies, J. G. and Gill, J. C. (both, Jodrell Bank Experimental Station), Radio-echo measurements of the orbits of faint sporadic meteors. Royal Astronomical Society, London, Monthly Notices, 121(5):437-462, Dec. 1960. 12 figs., 5 tables, 18 refs. DLC--

A survey has been made of the orbits of faint sporadic meteors. The results show that, in addition to meteors moving in orbits similar to those of the comets, there are many in orbits of very short period. The more eccentric of these orbits are concentrated toward the plane of the ecliptic, but some are nearly circular and have inclinations near 60°. The differences between these results and those previously published for bright meteors are discussed, and a qualitative explanation is given in terms of the action on near parabolic orbits of solar radiation and the major planets. --Authors' abstract.

B-350 Dudnik, B. S.; Kashcheev, B. L.; Lagutin, M. F. et al., The velocity of meteors of the Geminid shower. Soviet Astronomy AJ, New York, 3(1):143-146, Jan./Feb. 1959. 6 figs., 2 refs., 3 eqs. DLC. Transl. of original Russian in Astronomicheskii Zhurnal, Moscow, 36(1):141-145, Jan./Feb. 1959. DLC--The results of measurements of meteor velocities by radar echo techniques during the Geminid shower are given. Measurements are carried out from 23h to 5h UT from Dec. 10-14. The bulk of the 569 velocity measurements (for 226 meteors) fell within a range of 32.5 to 37.5 km/sec; the average velocity over that range was 35.9 km/sec. The radiants of the meteors were not determined, and sporadics are therefore not excluded from the total quantity. (Met. Abst. 11L-192)--Authors' abstract.

B-351 Eckersley, T. L., An investigation of short waves. Institute of Electrical Engineers, Proceedings, 67(392):992-1032, Aug. 1929. 30 figs., 4 tables, refs.--Discovery of burst signals within the normal skip zone was made during a 2-yr investigation discussed in terms of scattering, long and short distance direction finding, magnetic storms, skip effects and whistlers.--W. N.

B-352 Fialko, E. I., Novyi metod izmereniia vysoty odnorodnoi atmosfery. (New method of measuring the height of a homogeneous atmosphere.) Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz., No. 12:1891-1894, Dec. 1959. fig., 5 refs., 9 eqs. DWB, DLC--The author examines the possibility of measuring the height of a homogeneous atmosphere in the meteor zone H(h) by using the relationship $h_m(v)$ where h_m - characteristic height that differs slightly from the mean height h of the meteors and h(v) - mean height of the meteors grouped according to their velocities. The dependence of the characteristic height of meteors $h_m(h_{min})$ upon the parameters of a meteor and radar is examined and an equation expressing the increase in the manner of distribution of the altitudes Δh_m resulting from the transition from v, x, m_{min} to v_2, x_2, m_{min2} is derived, namely

$$\Delta h_m(m_{min}) \approx 2.H. \ln \frac{v2}{v1} + H \ln \frac{\cos X_1}{\cos X_2} + \frac{H}{3} \ln \frac{m_{min\ 1}}{m_{min\ 2}}$$

Where $B = h_o + H \frac{\ln p_o}{Q}$; p_o - pressure at height h_o (h_o - within the limits of the meteor zone); H - height of homogeneous atmosphere corresponding to h_m ; Q - coefficient depending upon the parameter characterizing the physical and geometrical properties of the meteor; X - zenith distance of the meteor; m - man of the meteor. The methods for measuring the height of a homogeneous atmosphere are developed and the relevant equations are presented. Here are

$$H \approx \frac{h_m}{2 \ln v_2/v_1} \qquad H \approx \frac{\Delta h_m}{2.33 \ln v_2/v_1}$$

$$H \approx \frac{\Delta h_m}{\ln \frac{\cos X_1}{\cos X_2}} \quad \text{and} \quad H \approx 3 \frac{\Delta h_m}{\ln \frac{m_{min\ 1}}{m_{min\ 2}}}$$

Quantitative measurements are presented. In determination of the mean altitude of homogeneous atmosphere in the meteor zone is illustrated. --I. L. D.

B-353 Fialko, E. I. (Tomsk Poly. Inst.), A new method for determining the radiant of a meteor stream, using an antenna of low directivity. Soviet Astronomy AJ, New York 3(1): 136-138, Jan./Feb. 1959. 3 figs., 2 refs. DLC. Transl. of original Russian in Astronomicheskii Zhurnal, Moscow, 36(1):134-136, Jan./Feb. 1959. DLC--The possibility of measuring the coordinates of a meteor stream using an antenna of low directivity is considered. (Met. Abst. 11L-149)--Author's abstract.

B-354 Fialko, E. I. (Tomsk Polytech. Inst.), Radar observations of the Perseids during 1957. Soviet Astronomy AJ, New York, 3(2):306-309, Mar./April 1959. 4 figs., 7 refs., 3 eqs. DLC. Transl. of original Russian in Astronomicheskii Zhurnal, Moscow, 36(2):311-314, Mar./April 1959. DLC--

During 24 hour radio echo observations on $\lambda = 10$ m made during Aug. 11-12, 1957 in Tomsk, two maxima (a daytime and nighttime) in the number of radio echoes were registered. The daytime maximum (as well as the nighttime) is due to the Perseid stream. (Met. Abst. 11L-193)--Author's abstract.

B-355 Fialko, E. I., K voprosu o raspredelenii meteornykh tel po skorostiam. (Velocity distribution of meteoroids.) Astronomicheskii Zhurnal, Moscow, 37(2):354-356, March/April 1960. 3 figs., 6 refs. Russian and English summaries p. 354. Translation into English in Soviet Astronomy AJ, New York, 4(2):334-336, 1960. DLC--The velocity distribution of meteoroids differs from the velocity distribution of meteors as measured by radar. Although the radar method is selective, it may be considered on the basis of the results of meteor velocity measurement that the relative number of meteoroids of inter-stellar origin is extremely small. (Met. Abst. 11L-173)--Author's abstract.

B-356 Fialko, E. I., Raspredelenie meteornykh radioekho po dlitel'nosti, II, Otrazheniia ot neustoichivykh sledov. (The duration distribution of meteor radio echoes, Pt. 2, Reflections from unstable trails.) Astronomicheskii Zhurnal, Moscow, 37(3):526-529, May/June 1960. fig., 4 refs., 11 eqs. Russian and English summaries p. 526. Transl. into English in Soviet Astronomy AJ, New York, 4(3):1960. DLC--An approximate expression has been obtained for the duration distribution of meteor radio echoes received from the characteristic height region, in the case of unstable trails. The character of the distribution of reflections according to durations is determined by the law of distribution of meteor bodies with mass, the velocity of meteoric bodies and the wavelength of the locator. (Met. Abst. 11L-174)--Author's abstract.

B-357 Greenhow, J. S. and Hall, J. E. (both, Jodrell Bank Experimental Station), The variation of meteor heights with velocity and magnitude. Royal Astronomical Society, London, Monthly Notices, 121(2):174-182, 1960. 3 figs., 19 refs., 11 eqs. --The variation of the heights of occurrence of meteors, with velocity and magnitude, are compared with theoretical predictions. The photographic observations are shown to be in good agreement with theory over the range of zenithal visual magnitudes from -3 to $+3$ and for velocities of 13 to 70 km/sec. Very large departures from the predicted heights are found for radio echo observations of $+6$ magnitude meteors. Reasons for these departures are discussed. (Met. Abst. 11L-176)--Authors' abstract.

B-358 Katasev, L. A.; Korpusov, V. N. and Orlianskii, A. P. (all, Inst. of Applied Geophysics, Academy of Sciences USSR), Radar echo observations of meteors using two receivers of different sensitivity. Soviet Astronomy AJ, New York, 4(1):110-113, July/Aug. 1960. fig., 2 tables, 5 refs., 6 eqs. DLC. Transl. of original Russian in Astronomicheskii Zhurnal, Moscow, 37(1):115-118, Jan./Feb. 1960. DLC--Results are given of a study of the S parameter of the distribution of meteoric bodies with respect to mass for the 1959 Quadrantid shower. It is shown that S did not remain constant, but varied with time, and reached a peak value of 2.96 at about 5h - 7h UT on Jan. 4, 1959. A derivation of a formula for determining the diffusion coefficient D on the basis of radar echo observations of meteors, using two receiving sets of unequal sensitivity, is given. (Met. Abst. 11L-178)--Authors' abstract.

B-359 Kent, G. S. (Univ. College of Ibadan, Nigeria), The fading of radio waves reflected obliquely from meteor trails. Journal of Atmospheric and Terrestrial Physics, London, 19(3/4):272-283, Dec. 1960. 6 figs., table, 12 refs. DWB--A study has been made of bursts of signal received at Cambridge over a distance of 500 km from the 53.25 Mc/s BBC television transmitter at Kirk o' Shotts. These signal bursts, believed to be due to reflections from meteor trails, were usually found to fade at a rate of several cycles per second. This fading is believed to be due to changes in the diffraction pattern formed on the ground by waves scattered from separate parts of a meteor trail. By observing the signal bursts on two aerials spaced 200 m apart deductions have been made about the size of the structure in the diffraction pattern and the way in which it changes with time. It is concluded that the scale of the diffraction pattern is determined by the total length of the meteor trail rather than by the size of the individual irregularities into which it breaks and the value found for the mean trail length is in good agreement with that found by other workers. The fading is found to be due to two causes, to random movements inside the trail and to rotation of the trail as a unit under the action of a wind shear. Values deduced for the r.m.s. random velocity and for the wind shear are again in agreement with those believed to exist in the E-region.--Author's abstract.

B-360 Nemirova, E. K. (S. M. Kirov Tomsk Poly. Inst.), The role of resonance effects in the measurement of meteor velocities. Soviet Astronomy AJ, New York, 3(3):470-474, Dec. 1959. 7 figs., 6 refs., 2 eqs. DLC. Transl. of original Russian in Astronomicheskii Zhurnal, Moscow, 36 (3):481-486, May/June 1959. DLC--

Some features of resonance scattering of radio waves by meteor trails are considered. An estimate is made of the influence of resonance on the form of the diffraction pattern and on the accuracy of the measurement of meteor velocities by the pulse diffraction method. --Author's abstract.

B-361 Nemirova, E. K. (Tomsk Polytech. Inst.), Some results of preliminary observations of resonance scattering of radio waves by meteor trails. Soviet Astronomy AJ, New York, 3(2):371-373, Mar./April 1959. fig., 2 tables, 2 refs. DLC. Transl. of original Russian in Astronomicheskii Zhurnal, Moscow, 36(2):377-379, Mar./April 1959. DLC--Special observations for an experimental investigation of the influence of resonance, during the scattering of radio waves by meteor trails, on the accuracy of the determination of some meteor characteristics are being made at the Tomsk Polytechnical Institute. In the present paper some results of preliminary observations are given. (Met. Abst. 11L-179)--Author's abstract.

B-362 Popova, M. D., Ob iskrivlenii puti nekotorykh meteorov pri ikh dvizhenii v zemnoi atmosfere. (The curvature of the paths of some meteors during their motion through the earth's atmosphere.) Astronomicheskii Zhurnal, Moscow, 37(2):352-353, March/April 1960. 2 figs. Russian and English summaries p. 352. Transl. into English in Soviet Astronomy AJ, New York, 4(2):332-334, 1960. DLC--The reality of the curvature of the path of some meteors during their motion through the atmosphere has been confirmed for the first time by photographic means. The microphotometer tracing taken shows that an actual change in the direction of motion of the meteoroid, not its disintegration, is involved. The hypothesis is proposed that the inhomogeneity of the meteoroid produced, at a certain height, a change in its form which led to the observed curvature of the meteor's path. (Met. Abst. 11L-181)--Author's abstract.

B-363 Schafer, J. P. and Goodall, W. M., Kennely-Heaviside layer studies employing a rapid method of virtual height determination. Institute of Radio Engineers, Proceedings, 20(7):1131-1148, July 1932. 5 figs., 4 refs.--A method used during the experimentation resumed in May 1931 at Dean enabled plotting of the visual pattern recordings of an oscillograph. Frequencies at 1604, 2398, 3256, 4795, and 6425 kc/s were employed. Curves of the increased night density of ionization from the lower and the upper layers are presented. Multiple reflections over 5000 km distance indicate the feasibility of multi-hop radio communication. --W. N.

B-364 Sugar, George R., Loss in channel capacity resulting from starting delay in meteor burst communication. U.S. National Bureau of Standards, Journal of Research, Sec. D, (Radio Propagation), 64(5):493-494, Sept./Oct. 1960. fig., 4 refs., 5 eqs. DWB, DLC--The loss in channel capacity of a meteor-burst communication system is computed as a function of the time required to initiate control of the system. The result is compared with various experimental data and appears to be applicable for signal bursts up to one-half second in duration. It is noted that in the very high frequency range the loss should increase with frequency. (Met. Abst. 11L-183)--Author's abstract.

B-365 Sugar, George R.; Carpenter, Robert J. et al, Elementary considerations of the effects of multipath propagation in meteor burst communication. U. S. National Bureau of Standards, Journal of Research, Sec. D, 64(5):495-500, Sept./Oct. 1960. 4 figs., table, 11 refs. DWB, DLC--Three mechanisms likely to regularly produce multipath propagation are examined. These are: (1) the simultaneous existence of two meteor trails; (2) the existence of a Rayleigh fading background continuum; and (3) the existence of two first-Fresnel zones along a single meteor trail. An analysis of the first mechanism indicated that in a typical meteor burst communication system two-trail propagation would cause transmission errors at a rate directly proportional to the system duty cycle. Satisfactory agreement was obtained between predicted and observed error rates for such a system. An examination of the significance of interference from the continuum in some wide-band transmission tests indicated that this source of multipath could be responsible for a significant fraction of the errors observed. The third mechanism was examined to determine the magnitude of the multipath delays it could produce. It was found that the effect of this single-trail multipath was likely to be significant only for the transmission rates in excess of 2×10^4 bands. However, the results of measurements at a rate of 10^5 bands indicated that even at this high rate over one-half of the transmissions were error free and that this latter type of multipath may not be of much importance in system design. (Met. Abst. 11L-184) --Authors' abstract.

B-366 Wait, James R., Scattering of a plane wave from a circular dielectric cylinder at oblique incidence. Canadian Journal of Physics, 33(5):189-195, May 1955. 6 refs., 32 eqs. --Complete solution of the basic problem is given and applied to some special cases. The results, while derived for a homogenous dielectric and permeable cylinder are applicable to a homogenous column of ionization, e.g. meteor trails and other radio wave propagation problems. --W. N.

B-367 Wheelon, Albert D., Amplitude distribution for radio signals reflected by meteor trails, Pt. 1. U. S. National Bureau of Standards, Journal of Research, Sec. D, 64(5):449-454, Sept./Oct. 1960. 4 figs., 3+ eqs. DWB, DLC--The probability distribution for the envelope of the received signal composed of reflections from many meteor trails is derived theoretically. Both the effects of numerous small meteors and the residual reflections from infrequent, large meteors are treated simultaneously. For the particular example of exponential decay of initial spikes which are themselves distributed as the inverse square of their amplitudes, we find that the probability that the composite residual signal amplitude exceeds a prescribed level r is given by

$$P(R > r) m \frac{1.}{1 + \left[\frac{r^2}{(vnQ)^2} \right]^{\frac{1}{2}}}$$

This function behaves as a Rayleigh distribution for small amplitude margins r. For the larger, less likely amplitudes it agrees with the result predicted by elementary analysis of isolated meteor reflections. Possible refinements of these results are also discussed. A second paper will discuss time correlation of composite meteor signals at different times. (Met. Abst. 11L-185)--Author's abstract.

Important Bibliographic Source

B-368 Manning, Laurence A., Survey of the literature of the ionosphere. Stanford Univ. Radio Propagation Laboratory, Contract AF 19(604)-686, Final Report, July 31, 1955. 650 p. illus., tables, eqs. --A fund of information on the physics of the ionosphere and on propagation of radio waves through the ionosphere is contained in this revised and extended survey which includes the majority of the 888 abstracts from the 1947 edition. The present survey covers the literature period 1928-1954 and is composed of 1517 abstracts especially written for this report. (See Met. Abst. 8.8-70). In addition to the 155 abstracts indexed under "Meteors" at least an equal number of abstracts with bearings on meteoric propagation are found under closely related categories. --W. N.

AUTHOR INDEX

U. S. DEPARTMENT OF COMMERCE
Luther H. Hodges, Secretary

NATIONAL BUREAU OF STANDARDS
A. V. Astin, Director

THE NATIONAL BUREAU OF STANDARDS

The scope of activities of the National Bureau of Standards at its major laboratories in Washington, D.C., and Boulder, Colorado, is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section carries out specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant publications, appears on the inside of the front cover.

WASHINGTON, D.C.

Electricity. Resistance and Reactance. Electrochemistry. Electrical Instruments. Magnetic Measurements. Dielectrics.

Metrology. Photometry and Colorimetry. Refractometry. Photographic Research. Length. Engineering Metrology. Mass and Scale. Volumetry and Densimetry.

Heat. Temperature Physics. Heat Measurements. Cryogenic Physics. Equation of State. Statistical Physics.

Radiation Physics. X-ray. Radioactivity. Radiation Theory. High Energy Radiation. Radiological Equipment. Nucleonic Instrumentation. Neutron Physics.

Analytical and Inorganic Chemistry. Pure Substances. Spectrochemistry. Solution Chemistry. Standard Reference Materials. Applied Analytical Research.

Mechanics. Sound. Pressure and Vacuum. Fluid Mechanics. Engineering Mechanics. Rheology. Combustion Controls.

Organic and Fibrous Materials. Rubber. Textiles. Paper. Leather. Testing and Specifications. Polymer Structure. Plastics. Dental Research.

Metallurgy. Thermal Metallurgy. Chemical Metallurgy. Mechanical Metallurgy. Corrosion. Metal Physics. Electrolysis and Metal Deposition.

Mineral Products. Engineering Ceramics. Glass. Refractories. Enameled Metals. Crystal Growth. Physical Properties. Constitution and Microstructure.

Building Research. Structural Engineering. Fire Research. Mechanical Systems. Organic Building Materials. Codes and Safety Standards. Heat Transfer. Inorganic Building Materials.

Applied Mathematics. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics. Operations Research.

Data Processing Systems. Components and Techniques. Digital Circuitry. Digital Systems. Analog Systems. Applications Engineering.

Atomic Physics. Spectroscopy. Infrared Spectroscopy. Solid State Physics. Electron Physics. Atomic Physics.

Instrumentation. Engineering Electronics. Electron Devices. Electronic Instrumentation. Mechanical Instruments. Basic Instrumentation.

Physical Chemistry. Thermochemistry. Surface Chemistry. Organic Chemistry. Molecular Spectroscopy. Molecular Kinetics. Mass Spectrometry.

Office of Weights and Measures.

BOULDER, COLO.

Cryogenic Engineering. Cryogenic Equipment. Cryogenic Processes. Properties of Materials. Cryogenic Technical Services.

Ionosphere Research and Propagation. Low Frequency and Very Low Frequency Research. Ionosphere Research. Prediction Services. Sun-Earth Relationships. Field Engineering. Radio Warning Services.

Radio Propagation Engineering. Data Reduction Instrumentation. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Propagation-Terrain Effects. Radio-Meteorology. Lower Atmosphere Physics.

Radio Standards. High Frequency Electrical Standards. Radio Broadcast Service. Radio and Microwave Materials. Atomic Frequency and Time Interval Standards. Electronic Calibration Center. Millimeter-Wave Research. Microwave Circuit Standards.

Radio Systems. High Frequency and Very High Frequency Research. Modulation Research. Antenna Research. Navigation Systems.

Upper Atmosphere and Space Physics. Upper Atmosphere and Plasma Physics. Ionosphere and Exosphere Scatter. Airglow and Aurora. Ionospheric Radio Astronomy.

NBS