NISTIR 5275

Electronics and Electrical Engineering Laboratory

Technical Publication Announcements

J. M. Rohrbaugh
Compiler

October 1993

Covering Laboratory Programs,
April to June 1993
with 1993-1994 EEEL Events Calendar

37

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Institute of Standards and Technology
Electronics and Electrical Engineering Laboratory
Semiconductor Electronics Division
Gaithersburg, MD 20899

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INTRODUCTION TO THE EEEL TECHNICAL PUBLICATION ANNOUNCEMENTS

This is the thirty-seventh issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology Electronics and Electrical Engineering Laboratory (EEEL). This issue of the EEEL Technical Publication Announcements covers the second quarter of calendar year 1993.

Organization of Bulletin: This issue contains citations and abstracts for Laboratory publications published in the quarter. Entries are arranged by technical topic as identified in the Table of Contents and alphabetically by first author within each topic. Following each abstract is the name and telephone number of the individual to contact for more information on the topic (usually the first author). This issue also includes a calendar of Laboratory conferences and workshops planned for calendar year 1993/1994 and a list of sponsors of the work.

Electronics and Electrical Engineering Laboratory: EEEL programs provide national reference standards, measurement methods, supporting theory and data, and traceability to national standards. The metrological products of these programs aid economic growth by promoting equity and efficiency in the marketplace, by removing metrological barriers to improved productivity and innovation, by increasing U.S. competitiveness in international markets through facilitation of compliance with international agreements, and by providing technical bases for the development of voluntary standards for domestic and international trade. These metrological products also aid in the development of rational regulatory policy and promote efficient functioning of technical programs of the Government.

The work of the Laboratory is conducted by four technical research Divisions: the Semiconductor Electronics and the Electricity Divisions in Gaithersburg, Md., and the Electromagnetic Fields and Electromagnetic Technology Divisions in Boulder, Colo. In 1991, the Office of Law Enforcement Standards, formerly the Law Enforcement Standards Laboratory, was transferred to EEEL. This Office conducts research and provides technical services to the U.S. Department of Justice, State and local governments, and other agencies in support of law enforcement activities. In addition, the Office of Microelectronics Programs (OMP) was established in EEEL to coordinate the growing number of semiconductor-related research activities at NIST. Reports of work funded through the OMP are included under the heading "Semiconductor Microelectronics."

Key contacts in the Laboratory are given on the inside back cover; readers are encouraged to contact any of these individuals for further information. To request a subscription or for more information on the Bulletin, write to EEEL Technical Progress Bulletin, National Institute of Standards and Technology, Metrology Building, Room B-358, Gaithersburg, MD 20899 or call (301) 975-2220.

Laboratory Sponsors: The Laboratory Programs are sponsored by the National Institute of Standards and Technology and a number of other organizations, in both the Federal and private sectors; these are identified on page 8.

Note on Publication Lists: Publication lists covering the work of each division are guides to earlier as well as recent work. These lists are revised and reissued on an approximately annual basis and are available from the originating division. The current set is identified in the Additional Information section, page 4.

Certain commercial equipment, instruments, or materials are identified in this paper in order to specify adequately the experimental procedures. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment are necessarily the best available for the purpose.

TABLE OF CONTENTS

SEMICONDUCTOR MICROELECTRONICS

Photodetectors

Gallawa, R.L., Gardner, J.L., Nettleton, D.H., and Stock, K.D., **International Intercomparison of Detector Responsivity at 1300 and 1550 nm**, Conference on Precision Electromagnetic Measurements (CPEM '92), Paris, France, June 9-12, 1992, pp. 268-269 (1993).

An international intercomparison of spectral responsivity measurements at wavelengths of interest to optical communications was recently completed. Thirteen countries participated in the test, which was conducted in the course of a year. Agreement is within about 1%.
[Contact: Robert L. Gallawa, (303) 497-3761]

SIGNAL ACQUISITION, PROCESSING, AND TRANSMISSION

Cryoelectronic Metrology

Ekin, J.W., Russek, S.E., Clickner, C.C., and Jeanneret, B., **In-Situ Noble Metal/$YBa_2Cu_3O_7$ Thin-Film Contacts**, Applied Physics Letters, Vol. 62, No. 4, pp. 369-371 (January 25, 1993).

Thin-film contacts to $YBa_2Cu_30_7$ have been fabricated by an *in-situ* noble-metal process and patterned down to 2 x 2 μm; at this small size, the contacts carry transport current over 10^6 A/cm^2 while maintaining a specific contact resistivity ρ_c in the 10^{-8} to 10^{-9} Ω cm^2 range. No oxygen annealing was used in the processing, thus avoiding the problem of silver or gold agglomeration, as well as preserving a sharp interface for Josephson-device applications. ρ_c was measured to increase only ~25% as temperature was increased from 4 to 90 K. The measurements were carried out on a series of film morphologies using both superconductor-normal metal and superconductor-normal metal-superconductor test structures; a carefully designed test pattern was used to correct for spreading conduction in the noble-metal contact layer. The contacts were ohmic with voltage-current characteristics that were linear over more than four orders of magnitude.
[Contact: John W. Ekin, (303) 497-5448]

Laser Metrology

Jones, R.D., and Scott, T.R., **Laser-Beam Analysis Pinpoints Critical Parameters**, Laser Focus World, Vol. 29, No.1, pp. 123-130 (January 1993).

We demonstrate the need for measuring laser beam parameters such as diameter, divergence, and propagation constant. These terms are defined and methods for their measurement are described. We make the point that assumption of ideal beam properties can result in degraded optical performance.
[Contact: Richard D. Jones, (303) 497-3439]

Optical Fiber Metrology

Gallawa, R.L., Pal, B.P., and Goyal, I.C., **LP_{11}-Mode Leakage Loss in Coated Depressed Clad Fibers**, IEEE Photonics Technology Letters, Vol. 4, No. 4, pp. 376-378 (April 1992).

A quantitative investigation of the leakage loss spectrum of the LP_{11}-mode in coated depressed index clad fibers is made using the matrix method. The study reveals oscillations similar to those seen in the measurement of cutoff wavelength. Our results do not agree with recently published results, and a plausible explanation of the discrepancies is given.
[Contact: Robert L. Gallawa, (303) 497-3761]

Young, M., Mechels, S.E., and Hale, P.D., **Optical Fiber Geometry: Accurate Measurement of Cladding Diameter,** Conference on Precision Electromagnetic Measurements (CPEM '92), Paris, France, June 9-12, 1992, pp. 202-203 (1993).

This paper reports progress toward developing an artifact standard for video microscopes devoted to measuring optical fiber geometry. Specifically, we have developed three devices, a contact micrometer, a scanning confocal microscope, and a white-light interference microscope, that are capable of absolute measurements with accuracy between 50 and 100 nm.
[Contact: Matt Young, (303) 497-3223]

Optical Fiber/Waveguide Sensors

Day, G.W., Deeter, M.N., and Rose, A.H., **Faraday**

Effect Current Sensors, Proceedings of the 17th Australian Conference on Optical Fiber Technology, Hobart, Tasmania, Australia, November 29-December 4, 1992, pp. 20-27.

This paper contains a review of Faraday effect current sensors, including both those based on bulk materials and on single mode optical fiber. Among the topics discussed are new materials for bulk-based sensors leading to the best reported sensitivities, methods of dealing with fiber birefringence, temperature stability, speed limitations, and new configurations, including the Sagnac interferometer. It is largely a condensation of an earlier review paper, "Faraday Effect Sensors: A Review of Recent Progress," in *Optical Fiber Sensors,* SPIE Optical Engineering Press (1992).
Contact: Gordon W. Day, (303) 497-5204]

Electro-Optic Metrology

Hickernell, R.K., Takada, K., Yamada, M., Shimizu, M., and Horiguchi, M., **Pump-Induced Dispersion of Erbium-Doped Fiber Measured by Fourier Transform Spectroscopy**, Optics Letters, Vol. 18, No. 1, pp. 19-21 (January 1, 1993).

We report the measurement of group index and dispersion in an erbium-doped fiber amplifier by Fourier transformation of low-coherence interferograms. In a germania-codoped fiber whose background dispersion was -14 ps/(km nm), we measured resonant gain-induced changes as high as 9 and -12 ps/(km nm) near 1.536 μm. The interferometric measurements agree with calculations based on a Kramers-Kronig transformation of absorption and emission spectra.
[Contact: Robert K. Hickernell, (303) 497-3455]

Malone, K.J., Sanford, N.A., Hayden, J.S., and Sapak, D.L., **Integrated Optic Laser Emitting at 906, 1057, and 1358 nm**, Proceedings of Advanced Solid-State Lasers, New Orleans, Louisiana, February 1-3, 1993, unpaged.

We have achieved laser oscillation at 906, 1057, and 1358-nm in the same neodymium-doped-glass integrated optic laser. We believe this is the first report of a 906-nm integrated optic laser. High slope efficiency and high output power were observed at 1057-nm. The laser was fabricated by silver ion exchange in a phosphate glass.
[Contact: Kevin J. Malone, (303) 497-3289]

Sanford, N.A., Aust, J.A., Malone, K.J., and Larson, D.R., **Linewidth Narrowing in an Imbalanced Y-Branch Waveguide Laser**, Optic Letters, Vol. 18, No. 4, pp. 281-283 (February 15, 1993).

A Y-branch channel waveguide laser whose branch segments were mismatched in length by 2.4% was fabricated by electric-field-assisted ion exchange in Nd-doped, mixed alkali-silicate glass. The laser output wavelength was centered at 1057.3 nm, and the linewidth was 0.4 nm FWHM. Our similarly fabricated single-channel Fabry-Perot lasers and balanced Y-branch lasers display linewidths of 3 to 4 nm. Pumping was performed with a cw Ti:sapphire laser operating at 785 nm. The imbalanced Y-branch laser reached threshold with an absorbed pump power of 48 mW when a 2% transmitting output coupler was used. The slope efficiency was 2%. An extended cavity was used to imbalance the arms in a second laser by a ratio of 2.8:1. This device displayed a linewidth of approximately 3.7 GHz FWHM. The linewidth narrowing of these coupled-cavity lasers is analogous to that seen in a Michelson laser.
[Contact: Norman A. Sanford, (303) 497-5239]

Schlager, J.B., Hale, P.D., and Franzen, D.L., **Metrology Applications of Mode-Locked Erbium Fiber Lasers**, Conference on Precision Electromagnetic Measurements (CPEM '92), Paris, France, June 9-12, 1992, p. 261 (1993).

Mode-locked erbium fiber lasers (MLEFLs) are a compact source of short optical pulses around 1540 nm. NIST has developed an "all" fiber design consisting of commercially available pigtailed components. Soliton pulse shaping helps produce sub-picosecond pulses. Characterization of high-speed detectors and fast optical waveforms has been realized using MLEFLs as a sampling pulse source.
[Contact: John B. Schlager, (303) 497-3542]

Takada, K., Kitagawa, T., Hattori, K., Yamada, M., Horiguchi, M., and Hickernell, R., **Direct Dispersion Measurement Of Highly-Erbium-Doped Optical Amplifiers Using a Low Coherence**

Reflectometer Coupled With Dispersive Fourier Spectroscopy, Electronics Letters, Vol. 28, No. 20, pp. 1889-1891 (September 24, 1992).

The group delay and dispersion, including the erbium ion contributions, of the highly-erbium-doped silica planar waveguide amplifier and multicomponent glass fibre amplifiers are directly measured at different pump powers using a low coherence reflectometer and dispersive Fourier spectroscopy. This method derives the refractive index spectra of these amplifiers directly from the produced reflectograms without any physical or mathematical assumptions. The dispersion of the planar waveguide amplifier at 500-mW pumping changes between +300 and -200 ps/km/nm with a 0.4 wt% erbium concentration.
[Contact: Robert K. Hickernell, (303) 497-3455]

ELECTRICAL SYSTEMS

Power Systems Metrology

Van Brunt, R.J., and Cernyar, E.W., **System for Measuring Conditional Amplitude, Phase, or Time Distribution for Pulsating Phenomena**, Journal of Research of the National Institute of Standards and Technology, Vol. 97, No. 6, pp. 635-672 (November-December 1992).

A detailed description is given of an electronic stochastic analyzer that can be used to make direct "real time" measurements of the conditional distributions needed for a complete stochastic characterization of pulsating phenomena such as partial discharges generated by applying alternating or constant voltage to an electrode gap containing insulating materials. The measurement system described here can be used to reveal and quantify effects of pulse-to-pulse and phase-to-phase memory propagation. The individual unique circuit components that comprise the system are thoroughly documented. Examples are shown of data obtained for conditional and unconditional amplitude, time interval, and phase-of-occurrence distributions of partial-discharge pulses generated in a point-to-dielectric discharge gap using constant and alternating excitation voltages. The results show, for example, that not only are the most probable amplitude and phase-of-occurrence of a discharge dependant on the amplitude and the phases of the preceding pulses but also on the integrated charge of all pulses that occurred during a previous voltage half-cycle. The significant memory propagation effects associated with partial-discharge phenomena examined here can be unraveled by the present measurement scheme. The unraveling of memory effects is required in order to achieve an understanding of the physical basis for observed statistical properties of pulsating phenomena. The method considered here can also provide more refined information needed for reliable partial-discharge pattern recognition. Sources of error and fundamental limitations of the present measurement approach are analyzed. Possible extensions of the method are also discussed.
[Richard Van Brunt, (301) 975-2425]

Magnetic Materials and Measurements

Oti, J.O., **Micromagnetic Calculations of Dual-Layer Magnetic Recording Thin Films**, IEEE Transactions on Magnetics, Vol. 29, No. 2, pp. 1265-1275 (March 1993).

A micromagnetic model of dual-layer magnetic-recording thin films is described. The model, which is capable of simulating magnetic layers having different magnetic and geometric properties, is applied to the study of the magnetic properties of dual-layer media that is characterized by a three-dimensional isotropic distribution of anisotropy axes in both layers, using parameters typical of cobalt-alloy films. In the absence of exchange interactions between the layers, a correlation is found between squareness ratios, average magnetostatic energy densities, and structural dimensions of the media. An in-phase magnetization reversal of the layers is found to occur with increasing interlayer exchange coupling. A complex relationship is found between coercivity and media parameters.
[Contact: John O. Oti, (303) 497-5557]

ADDITIONAL INFORMATION

Lists of Publications

DeWeese, M.E., **Metrology for Electromagnetic Technology: A Bibliography of NIST Publications**, NISTIR 3994 (September 1992).

This bibliography lists the publications of the personnel of the Electromagnetic Technology Division of NIST in the period from January 1970 through publication of this report. A few earlier references that are directly related to the present work of the Division are included.
[Contact: Annie Smith, (303) 497-3678]

Lyons, R.M., and Gibson, K.A., **A Bibliography of the NIST Electromagnetic Fields Division Publications**, NISTIR 3993 (August 1992).

This bibliography lists publications by the staff of the National Institute of Standards and Technology's Electromagnetic Fields Division for the period from January 1970 through August 1992. Selected earlier publications from the Division's predecessor organizations are included.
[Contact: Kathryn A. Gibson, (303) 497-3132]

Meiselman, B., **Electrical and Electronic Metrology: A Bibliography of NIST Electricity Division's Publications, NIST List of Publications 94** (January 1993).

This bibliography covers publications of the Electricity Division, Electronics and Electrical Engineering, Laboratory, NIST, and of its predecessor sections for the period January 1968 to December 1992. A brief description of the Division's technical program is given in the introduction.
[Contact: Betty Meiselman, (301) 975-2401]

Walters, E.J., **Semiconductor Measurement Technology, 1990-1992, NIST List of Publications 103** (April 1993) and **Semiconductor Measurement Technology, 1962-1989, NIST List of Publications 72** (March 1990).

The bibliography provides information on technology transfer in the field of microelectronics at NIST for the calendar years 1990 and 1992. Publications from groups specializing in semiconductor electronics are included, along with NIST-wide research now coordinated by the NIST Office of Microelectronics Programs which was established in 1991. Indices by topic area and by author are provided. Earlier reports of work performed during the period from 1962 through December 1989 are provided in NIST List of Publications 72.
[Contact: E. Jane Walters, (301) 975-2050]

Availability of *Measurements for Competitiveness in Electronics* [First Edition], NISTIR 4583 (April 1993).

This document is the successor to NISTIR 90-4260, *Emerging Technologies in Electronics ...and their Measurement Needs* [Second Edition]. The new *Measurements for Competitiveness in Electronics* identifies the measurement needs that are most critical to U.S. competitiveness, that would have the highest economic impact if met, and that are the most difficult for the broad range of individual companies to address. The document has two primary purposes: (1) to show the close relationship between U.S. measurement infrastructure and U.S. competitiveness, and show why improved measurement capability offers such high economic leverage and (2) to provide a consensus on the principal measurement needs affecting U.S. competitiveness, as the basis for an *action plan* to meet those needs and to improve U.S. competitiveness.

Copies of this document are available as Order No. PB93-160588 from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, at (800) 553-6847 or (703) 487-4650.

Abstract -- Measurements are used to determine the values of hundreds of important quantities in the electronics industry. Representative quantities are the widths of the interconnections within semiconductor integrated circuits, the attenuation of lightwaves in optical fibers, and the signal power from microwave satellite antennas. Measurement capability is a fundamental tool used to build the nation's high-technology products. As such, it is part of the national infrastructure for the realization of these products.

Measurement capability is critical to research and development, manufacturing, marketplace entry, and after-sales support of products. Thus, measurement capability affects the performance, quality, reliability, and cost of products. The result of this pervasive impact is that the level of U.S. measurement capability places an upper limit on the competitiveness of U.S. products.

At present, U.S. industry is experiencing a major shortfall in the measurement capability needed for competitiveness in electronic products. This document identifies the measurement needs that are

most critical to U.S. competitiveness, that would have the highest economic impact if met, and that are the most difficult for the broad range of individual companies to address. The measurement needs are reviewed for nine important fields of electronics, including semiconductors, magnetics, superconductors, microwaves, lasers, optical-fiber communications, optical-fiber sensors, video, and electromagnetic compatibility. These fields of electronics underlie more than $300 billion of electronic and electrical products manufactured in the U.S. each year.

This assessment provides the framework for an action plan to correct the shortfall in U.S. measurement capability in electronics and to advance U.S. competitiveness.

Guide -- The compiler of the document provided an introductory guide to its organization and content. Because EEEL believes that a number of *TPB* readers will be interested in the information presented in the various chapters, the contents of this guide are reproduced below (page numbers of chapter summaries are included to provide a measure of the extent of the treatment):

This document contains 12 chapters, divided into two groups. The first three chapters are introductory in nature and are relevant to all of the following chapters. The remaining nine chapters address individual fields of electronic technology. Each chapter begins with a two-page summary that provides ready access to the major points made in the chapter. These short summaries are found on the pages identified below. By selecting from these summaries, you can quickly access information on the subjects of most interest to you.

Introductory Information -- Chapter 1, Role of Measurements in Competitiveness (page 3); Chapter 2, NIST's Role in Measurements (page 21); Chapter 3, Overview of U.S. Electronics and Electrical-Equipment Industries (page 31)

These three chapters introduce the subject of measurements and provide an overview of the products of the U.S. electronics and electrical-equipment industries.

Chapter 1, **Role of Measurements in Competitiveness**, shows why measurements are a fundamental part of the infrastructure of the nation. Chapter 1 also sets measurements in the context of the many other important factors that affect competitiveness.

Chapter 2, **NIST's Role in Measurements**, indicates the circumstances under which Government assistance to industry in the development of measurement capability is appropriate in pursuit of a strengthened national economy.

Chapter 3, **Overview of U.S. Electronics and Electrical-Equipment Industries**, introduces these industries through an overview of their major product lines. This chapter shows the various ways in which the products of these industries are commonly classified and how those classifications relate to the structure of this document.

Fields of Technology -- Chapter 4, Semiconductors (page 53); Chapter 5, Magnetics (page 95); Chapter 6, Superconductors (page 129); Chapter 7, Microwaves (page 147); Chapter 8, Lasers (page 183); Chapter 9, Optical-Fiber Communications (page 217); Chapter 10, Optical-Fiber Sensors (page 303); Chapter 11, Video (page 339); Chapter 12, Electromagnetic Compatibility (page 381).

Each of these chapters contains four basic types of information:

Technology Review: The field of technology is reviewed to highlight and explain the special capabilities that make the technology important. This review introduces the technical concepts that are necessary for understanding the sections that follow.

World Markets and U.S. Competitiveness: The economic significance of the field of technology is highlighted through use of national and international market data for major products that employ the technology. Available information on the U.S. competitiveness is described.

Goals of U.S. Industry for Competitiveness: The goals that U.S. industry is pursuing to improve its competitiveness are discussed so that they can be related to requirements for new measurement capability supportive of the goals.

Measurement Needs: The new measurement capability that U.S. industry will need to enable it to achieve its goals is described. This discussion emphasizes measurement capability that is needed widely in U.S. industry, that will have high economic impact if provided, and that is beyond the resources of the broad range of individual U.S. companies to provide.

[While the assessment of measurement needs in this document is wide ranging, not every field of technology important to the electronic and electrical-equipment industries has been covered. NIST plans to expand this assessment in future editions to include additional fields.]

The order in which chapters appear is intentional: the technologies on which most other technologies depend are introduced first. Thus, the chapter on semiconductors appears first because most electronic technologies depend on semiconductor materials. In contrast, the chapter on video is located near the end because it depends on nearly every other technology discussed earlier.

Chapters 4, 5, and 6 of this document describe the measurement needs arising from three important materials technologies that underlie current and emerging electronic and electrical products. These chapters also describe the measurement needs of components and equipment based on these materials and not discussed separately in other chapters.

Chapter 4, **Semiconductors**, addresses both silicon and compound semiconductors and their use in components, including individual (discrete) electronic and optoelectronic devices and integrated circuits. Semiconductor components are central to all modern electronic products from consumer products to supercomputers.

Chapter 5, **Magnetics**, focuses on both magnetic materials and the components made from them. Magnetic materials are second in importance only to semiconductor materials for electronic products and play a central role in electrical products. This chapter also addresses the measurement needs of selected equipment critically dependent on magnetic materials, including magnetic information storage equipment, electrical power transformers, and others.

Chapter 6, **Superconductors**, examines superconductor materials and addresses both present and emerging applications of these materials in electronic and electrical products.

Chapters 7 through 11 describe the measurement needs associated with selected technologies of importance to U.S. competitiveness for current and emerging products.

Chapter 7, **Microwaves**, describes the highest-information-capacity radio technology. Microwave electronics provide the basis for modern and emerging wireless communications systems and radar systems. Included are new personal communications services with both local and worldwide access, intelligent vehicle-highway systems, and advanced audio and video broadcasting systems, among others.

Chapter 8, **Lasers**, addressed the single most important component for emerging lightwave systems used for manufacturing, medicine, communications, printing, environmental sensing, and many other applications.

Chapter 9, **Optical-Fiber Communications**, describes the highest-information-capacity cable technology. It provides the basis for national and international information highways of unprecedented performance and broad economic impact. Optical-fiber systems will be linked with microwave systems to interconnect mobile and portable users and to backup cable systems.

Chapter 10, **Optical-Fiber Sensors**, focuses on an emerging class of sensors that offers outstanding performance for a broad spectrum of applications in manufacturing, aerospace, medicine, electrical power, and other areas.

Chapter 11, **Video**, emphasizes advanced, high-performance systems, such as high-definition television, which offer, for the first time, simultaneous access to high-resolution, smooth motion, and great color depth. The chapter notes the potential of full-power implementations of video technology in interactive networked environments. The chapter contains a special focus on flat-panel displays.

Chapter 12, **Electromagnetic Compatibility**, describes the special challenges that the U.S. faces in maintaining electromagnetic compatibility among the many new products of electronic and electrical technologies. Such compatibility is essential if the full potential of all of the above technologies is to be realized without debilitating mutual interference.

Appendices -- The three appendices provide definitions of the U.S. electronics and electrical-equipment industries. These definitions were used in preparing much of the economic information in the report.

Appendix 1 describes the Standard Industrial Classification System that the U.S. Government uses for collecting data about U.S. industry. This appendix also lists publications in which the U.S. Government reports data on U.S. shipments.

Appendix 2 provides a definition of the U.S. electronics industry in terms of the Standard Industrial Classification System.

Appendix 3 provides a definition of the U.S. electrical-equipment industry in terms of the Standard Industrial Classification System.

1993-1994 Calendar of Events

July 29, 1993 (Gaithersburg, Maryland)

Ion Implant Users Group Meeting. The 12th meeting of the Ion Implant Users Group will be held at NIST in July. General discussions of topics of interest to the group will be held.
[Contact: John Albers, (301) 975-2075]

October 11-13, 1993 (Yorktown Heights, New York)

IEEE CHMT VLSI Packaging Workshop. IEEE CHMT and NIST are sponsoring a workshop on VLSI packaging to be held at the T. J. Watson Research Center in Yorktown Heights. New developments or critical overviews in the following areas will be presented: VLSI package design; integrated package design; multichip module design; VLSI package materials and die attach solutions; VLSI package interconnection options: wire bonding, TAB, flip chip, and optical; failure mechanism and quality of VLSI packages; and silicon carrier MCMs. A tour of the IBM MLC line in East Fishkill and the TCM assembly and testing area in Poughkeepsie is included in the program.
[Contact: George G. Harman, (301) 975-2097]

October 28, 1993 (Gaithersburg, Maryland)

Ion Implant Users Group Meeting. The next regularly scheduled meeting of the Ion Implant Users Group will be held, as usual, at NIST in October. One of the topics scheduled for discussion is ion optics.
[Contact: John Albers, (301) 975-2075]

February 1-3, 1994 (San Jose, California)

10th Annual IEEE Semiconductor Thermal Measurement and Management Symposium (SEMI-THERM). Sponsored by IEEE CHMT and NIST, SEMI-THERM is the premier forum for the exchange of information on thermal management of electronics systems between the academic and industrial communities. The program will address the following topics: thermal characterization; analytical and computational thermal modeling; measurement techniques including temperature, fluid flow, and thermal-mechanical properties; and thermal reliability screening and testing. SEMI-THERM has a workshop atmosphere with single-session programs coupled with technical workshops, tutorials, vendor exhibits, and optional short courses.
[Contact: David L. Blackburn, (301) 975-2053]

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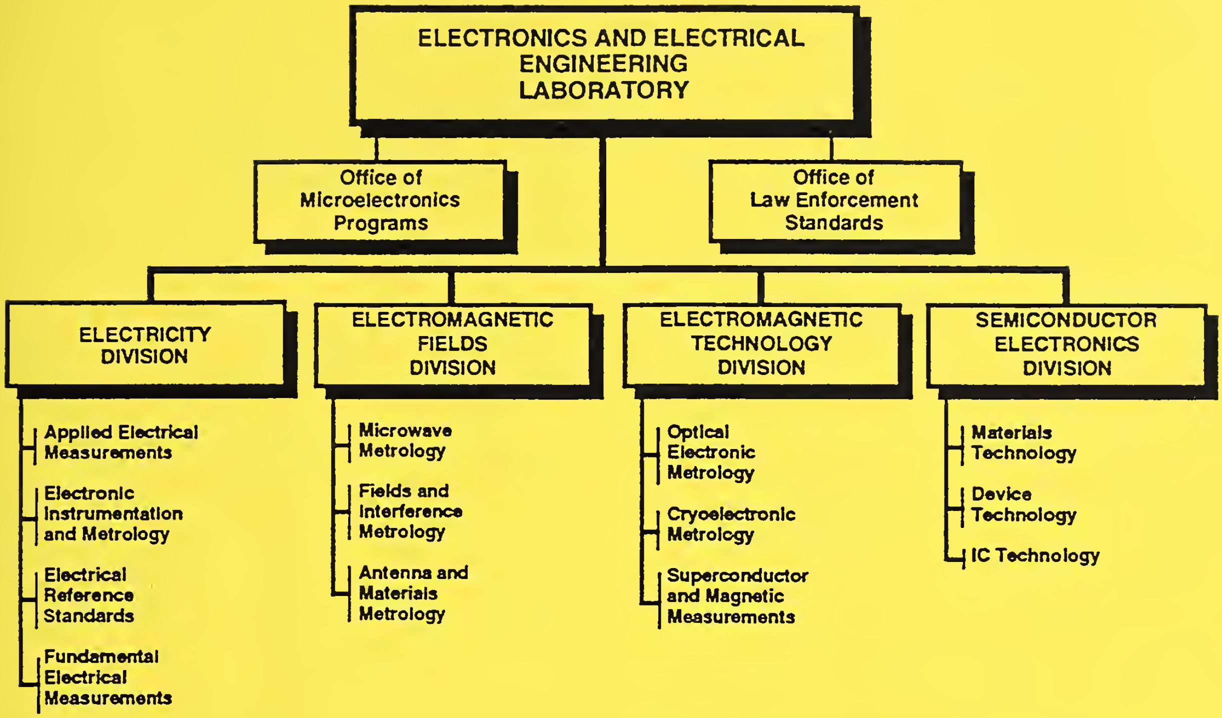

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