

News Briefs

Developments

LASER DOPPLER COOLING LIMIT FOR ATOMS BROKEN

Careful measurements of the temperature of "gases" of cooled atoms reveal that the *lowest temperatures achieved may be more than 10 times lower than the limit predicted* by the generally accepted model. These results were reported by a group of physicists from NBS, the University of Connecticut, and the State University of New York (SUNY) at Stony Brook in the July 11 issue of *Physical Review Letters*. Extremely low-temperature gases of free atoms or ions are produced in laboratories by "laser cooling." The generally accepted model of this process predicts a lower limit to the temperature that can be achieved by these techniques. The limit is different for each type of atom. Using four different methods, the NBS group measured the temperature of sodium atoms, laser-cooled in optical molasses, to be about 45 microkelvins, with an uncertainty of about 20 microkelvins—substantially below the presumed limit for sodium of about 240 microkelvins. Laser cooling experiments seek to create samples of free, isolated atoms or ions, moving very slowly in a confined region, where they can be probed by various techniques. Such experiments can make very accurate measurements of intrinsic properties of the atoms—measurements which in the past have led to important advances in the theories of quantum mechanics and relativity, among others.

PROGRAM SEEKS RESEARCHERS IN POLYMER COMPOSITES

A bureau research program to target the most critical barriers in high-performance polymer composite processing that producers must overcome to

meet increasing international competition *invites participation from researchers in industry, universities, and government.*

The U.S. market for high-technology plastic products, valued at approximately \$1.6 billion in 1987, is expected to grow to \$10 billion before the year 2000. The U.S. now has the technological lead in the use of high-performance polymer composites in defense and aerospace applications. In high-volume mass markets, however, U.S. industries face intense competition. Polymer composites are reinforced plastics carefully engineered to meet specific performance requirements. By combining polymer resins with reinforcements such as graphite fibers, very versatile, lightweight, and high-strength materials can be made. Examples include jet aircraft parts and sporting goods like tennis rackets and fishing rods.

For information on the program, contact Donald L. Hunston, A209 Polymers Bldg., National Bureau of Standards, Gaithersburg, MD 20899, telephone: 301/975-6837.

ENERGY MANAGEMENT AND CONTROL SYSTEMS COMPARED

In a comparison of two energy management and control systems (EMCS), researchers in the NBS Center for Building Technology found the microprocessor-based EMCS performed as well as, and in many cases better than and consumed less energy than, the pneumatic control system. The microprocessor-based system was developed by NBS and constructed of "off-the-shelf" components. The communication and control software also was written in-house. The system was installed in the NBS 11-story administration building along with the in-place pneumatic system. Both were monitored for a year. One advantage of the microprocessor system is ease of resetting and maintaining operating schedules. A problem with the pneumatic system is

that the tuning of the system "drifted" with time and was sensitive to changes made during routine maintenance. Another advantage of EMCS is more information about the performance of the system allowing problems to be discovered earlier and providing information for diagnosing a problem. *Comparison of Direct Digital Control and Pneumatic Control Systems in a Large Office Building* (NBSIR 88-3739) is available for \$14.95 prepaid from National Technical Information Service, Springfield, VA 22161. Order by PB #88-215470/AS.

ADVANCED SHIPYARD MANUFACTURING SYSTEM DEDICATED

Officials of NBS and the U.S. Navy's Naval Sea Systems Command (NAVSEA) on July 19 dedicated a *state-of-the-art robotic manufacturing system designed and assembled by NBS for the Navy's Mare Island (Calif.) Naval Shipyard*. The Mare Island workstation, scheduled for delivery to the shipyard this fall, will be one of a handful of facilities in the United States capable of operating, largely untended, 24 hours a day, five days a week. Consisting of an automated lathe, industrial robot, automated storage and retrieval system, and various control computers, and incorporating several advanced automation techniques, the workstation is designed to produce any of 40 different pipe connector parts used to suppress noise in nuclear submarines. Such parts are not stockpiled and are produced on demand when the submarine is serviced. Current manual production methods require about 17 hours to make one of these parts. The Mare Island workstation can machine the same part in under 30 minutes and is already turning out parts for the Navy on a trial basis. The advanced manufacturing techniques used in the workstation are applicable to any manufacturing operation.

TRACING INDUSTRIAL EMISSIONS TO THEIR SOURCES

In an effort to track emissions from coal-fired industrial plants to their sources, researchers at NBS and the University of Maryland have developed a technique that shows promise as a *simple and definitive way of tracing smoke particles*. It may be the first method suitable for tracing fine particles over long distances. Other techniques that use tracer gases detect only gaseous components of stack emissions, not particles. The NBS/Maryland work, sponsored by the Electric Power Research Institute, uses artificially enriched stable isotopes of rare earth elements as "tags" to permit positive identification by mass spectrometry of emission particles near the source or miles away. These

isotopes are nontoxic and inexpensive. Besides allowing samples to be traced to their sources, an analysis also can measure *how much of the tagged material is present*, in essence gauging the source's environmental impact. The NBS/Maryland scientists also hope to combine their study results with those of researchers examining gaseous emissions from coal-fired plants to produce a more complete picture of total emissions.

SQL TEST PACKAGE AVAILABLE FROM NBS

A package of tests to help users and vendors *determine compliance with a new Federal Information Processing Standard Publication (FIPS PUB) 127 for the Database Language SQL* is available for purchase from NBS. SQL is a voluntary industry standard language used to develop database management system applications. FIPS PUB 127 requires federal agencies to implement SQL in relational database management system applications acquired or developed after Aug. 3, 1988. The test suite will help both users and vendors meet the standard. Database management systems can save time and money by making data, application programs, and trained users "portable" from one system to another. The NBS test package includes six types of tests in three programming languages—C, FORTRAN, and COBOL. For further information, call Joan Sullivan (301/975-3258) or Joseph Collica (301/975-3267) or write to A266 Technology Bldg., National Bureau of Standards, Gaithersburg, MD 20899. FIPS PUB 127 is available from the National Technical Information Service, Springfield, VA 22161, 703/487-4650.

U.S., ITALY AGREE ON LUMINOUS INTENSITY STANDARD

NBS and the Istituto Elettrotecnico Nazionale "Galileo Ferraris" (IEN), Italy, signed an agreement on Apr. 15, 1988 recognizing the equivalency of their national standards for luminous intensity measurements as defined by the International System of Units (SI). The agreement, based on extensive interlaboratory comparisons, marks the seventh equivalency recognition between NBS and Italian national standards laboratories. The bureau and IEN recognize the equivalency of their national standards for voltage, electrical resistance and capacitance, and time. NBS also has an agreement with the Istituto di Metrologia "G. Colonnetti" of the Consiglio Nazionale delle Ricerche for length and temperature. Both the U.S. and Italy are signatories of the Convention of the Meter and determine their basic units of measurements in accordance with the definitions for SI

units adopted by the General Conference of Weights and Measures, an intergovernmental body that is the world authority on physical quantities and the ways they are measured. *These agreements facilitate the sale of products between the two countries* when traceability to national standards is required by contract or law.

U.S., ISRAEL RECOGNIZE EQUIVALENCE OF TIME STANDARDS

NBS and its Israeli equivalent, the National Physical Laboratory (INPL) in Jerusalem, signed an agreement on June 7 recognizing the equivalence of the unit of time measurement, the second, as kept by each country to at least one part in 10,000,000,000,000.

Both the U.S. and Israel measure seconds in accord with the definitions of the International System of Units (SI), which is maintained by the General Conference of Weights and Measures (CGPM).

The agreement between NBS and INPL essentially means that precision timing instruments calibrated against the standards of either country may be considered equally, as for example in meeting procurement specifications that require a calibration "traceable" to NBS or INPL. Such agreements require careful intercomparison of national standards to determine the level of accuracy at which "equivalence" can be said to exist. NBS has entered into several such agreements with foreign standards organizations to facilitate international trade.

Standard Reference Materials

STANDARD TO MEASURE CARBON IN NATURAL MATERIALS

To meet the needs of environmentalists and other researchers in science and industry, NBS has developed a new set of materials for *calibrating automated instruments to measure the carbon content in biological tissues and botanical specimens*. These devices, widely used in the metals industry for the rapid analysis of carbon in steel, produce highly sensitive and precise data when they are calibrated with accurate standards. Standard Reference Material (SRM) 1216, Carbon Modified Silica, is a set of three silica matrices certified for concentration levels of carbon at 0.70, 9.06, and 17.04 percent. Each of the three materials has been measured both by prompt gamma neutron activation and combustion techniques using known, highly characterized material as controls for their certification.

SRM 1216 is available for \$192 for the set of three materials from the Office of Standard Reference Materials, B311 Chemistry Bldg., National Bureau of Standards, Gaithersburg, MD 20899, telephone: 301/975-6776.

LOW ALLOY STEEL CALIBRATION STANDARDS ANNOUNCED

NBS has developed a new graded series of seven low alloy steel standards for calibrating optical emission and X-ray fluorescence spectrometers. Great care has been used in preparing these materials to obtain a high level of homogeneity to meet the demands of new, highly precise instruments *used in the quality control of alloy materials*. Standard Reference Materials (SRMs) 1761-1767, prepared in consultation with ASTM and industry, are intended as a replacement for the currently available 1260 series of low alloy steels. SRMs 1761-64 contain major and minor elements at normal concentration levels and SRMs 1765-1767 contain a graded series of elements at the trace levels. The new standards are available for \$135 each in the form of disks approximately 34 mm (1 3/8 in) in diameter and 19 mm (3/4 in) thick. To obtain information on the certified values of each disk, or to order the new graded series of calibration standards, contact the Office of Standard Reference Materials, B311 Chemistry Bldg., National Bureau of Standards, Gaithersburg, MD 20899, telephone: 301/975-6776.

Standard Reference Data

PUBLICATION OF SUPPLEMENT TO THE JOURNAL OF PHYSICAL AND CHEMICAL REFERENCE DATA ANNOUNCED

The Office of Standard Reference Data announced the publication of "Gas-Phase Ion and Neutral Thermochemistry" by S. G. Lias, J. E. Bartmess, J. F. Liebman, J. L. Holmes, R. D. Levin, and W. G. Mallard. This volume, the update of the 1977 publication "Energetics of Gaseous Ions," provides evaluated ionization energies for 5,000 molecules, atoms, and radicals, and proton affinities of 1,000 compounds, as well as electron affinities and gas phase acidities of approximately 3,000 species. The heats of formation of all relevant ions and the related neutral species are also included.

For information on the publication "Gas-Phase Ion and Neutral Thermochemistry," contact S. G. Lias, A317 Physics Bldg., National Bureau of Standards, Gaithersburg, MD 20899, telephone: 301/975-2506.

**OFFICE OF STANDARD REFERENCE DATA
SUPPORT FOR DATA COMPILATION
PROJECTS ANNOUNCED**

The Office of Standard Reference Data announced the awarding of new grants under its 1988 Program for Critical Compilations of Physical, Chemical, and Materials Data in July. The program, which is supported by funds from the National Science Foundation, offers support for projects involving the compilation and critical evaluation of data on well-defined chemical, physical, or materials properties. Each project must lead to a publishable compilation, critical review, or computer database containing recommended values for the properties in question along with an assessment of the reliability of these recommended values. The program is in its eighth year.

The new critical data evaluation projects which were approved for the coming year were:

- High temperature kinetic data for combustion- and propulsion-related chemistry (Dr. Norman Cohen, The Aerospace Corporation)
- Thermodynamic and phase diagram data for the binary systems of iron (Dr. H. Okamoto, ASM International)
- High temperature aqueous electrolyte data (Prof. Robert H. Wood, University of Delaware)
- Vaporization equilibria in one component systems (Dr. Vladimir Majer, University of Delaware)
- Thermodynamic data on lipid mesomorphic phase transitions and miscibility (Prof. Martin Caffrey, The Ohio State University)
- Absolute coverage of adsorbed molecules on transition metal surfaces (Prof. Torgny Gustafsson, The State University of Rutgers)
- Application of expert systems to critical evaluation of thermophysical property data (Drs. J. C. Holste and K. R. Hall, Texas A&M)
- Thermodynamic and Vaporization Data for Metal Sulfides (Prof. Paul W. Gilles, University of Kansas)

The program has been highly successful in drawing upon the expertise of scientists in universities and industry to add to the body of standard reference data available to the U. S. technical community.

**NBS FILE OF JANAF THERMOCHEMICAL
TABLES NOW AVAILABLE ONLINE
WORLDWIDE**

The third edition of the (Joint-Army-Navy-Air Force) *JANAF Thermochemical Tables*, published by the National Bureau of Standards (NBS), has been computerized to provide scientists and engineers with rapid access to important information

on the performance of materials at high temperatures.

The new JANAF file is available to subscribers of STN International (Scientific and Technical Network), an online private sector retrieval service offered worldwide. The computerized database eliminates the need to manually search through approximately 1,800 pages of thermochemical tables in two volumes.

The numerical data in the new JANAF file can be used by researchers and designers to make quick performance calculations for chemical reactors such as rocket engines, air pollution control equipment, automotive internal combustion engines, coal gasifiers and furnaces, fuel cells, liquefaction reactors and their catalyst structures, and magnetohydrodynamic generators. The information also can be used by engineers in the design of chemical plants.

The JANAF tables project was established in late 1959 at the Thermal Research Laboratory of the Dow Chemical Company, Midland, MI, as a way to compile and publish consistent tables of thermodynamic data required for rocket propellant performance calculations by industry and the Department of Defense agencies. Today the database is located in the NBS Chemical Thermodynamics Data Center, one of 23 data centers that make up the National Standard Reference Data System (NSRDS).

For information on the availability of the new JANAF file through STN, or the third edition of the *JANAF Thermochemical Tables* (1985), and the computer-readable database for lease on magnetic tape, contact the Office of Standard Reference Data, A323 Physics Bldg., National Bureau of Standards, Gaithersburg, MD 20899, telephone: 301/975-2208.