Scientific Meetings

Low-Temperature Physics

A conference on low-temperature physics sponsored by the Institut International du Froid and by L'Union Internationale de Physique pure et appliquée was held in Paris from 2 to 8 Sept. 1955. The meeting was held at the Sorbonne University, so that it would be closely associated with the 9th International Congress of Refrigeration, which took place at the Sorbonne at the same time.

The general committee for the conference included Francis Simon, C. J. Gorter, F. G. Brickwedde, K. Clusius, C. T. Lane, and L. Weil. L. Weil of the University of Grenoble presided over the organizing committee, which made arrangements not only for the scientific meetings but also for many notable social occasions. Approximately 250 delegates from about 15 different countries attended the conference; nearly 50 of them were from the United States. Listed on the program were 160 papers divided among the ten official sessions of the conference. Although this allowed little time for each paper, the presentations were helped considerably by publication and distribution of detailed abstracts of all papers immediately prior to the opening session.

It would not be possible in a short review even to mention all of the many significant scientific contributions in the field of low-temperature physics made at this conference. Consequently, I shall point out only a few papers that interested me personally. (The proceedings of the conference will be published shortly and will contain detailed abstracts of all the papers, together with reports of the discussions.)

In the area of experimental work on superconductivity, interesting new work was presented in papers by Corak, Goodman, Satterthwaite, and Wexler, by Goodman, and by Schawlow. The first two of these papers were concerned with measurement of the electronic specific heats of vanadium and aluminum, respectively. By accurate measurements over a wide range of reduced temperature $(5 > T_c/T > 1)$ it was observed that the electronic specific heat in the superconducting state, C_{es}, could be described by an exponential function. This is different from the analytic descriptions for C_{es} adopted to date and is of significance for theoretical descriptions of superconductivity, because it strongly suggests the existence of an energy gap in the single-electron energy level spectrum. The need for such an energy gap in the theoretical description of superconductivity has previously been stressed by many authors, in particular, recently, by Froehlich and Bardeen.

The third paper described results of observation of the structure of the intermediate state in superconductors by use of a magnetic powder technique. Diamagnetic superconducting niobium powder was spread over the surface of disks or plates of the samples to be investigated. When a sample was brought into the intermediate state by the application of a magnetic field, the powder remained on the superconducting regions but was forced out of the normal regions through which magnetic flux passed. The powder patterns were then observed photographically. From the observed domain spacings, the surface energy at the supernormal boundary can be derived, thus providing a powerful technique for obtaining this theoretically significant parameter. Tin, indium, lead, and vanadium were studied, and it was found that the surface energy for vanadium was some 1000 times larger than for the first three elements cited.

Among the many papers on liquid helium, two of interest concerning the entropy of superfluid helium were presented by Brewer, Edwards, and Mendelssohn and by Bots. The first paper described new measurements of the heat of transport of superfluid helium II flowing through narrow channels, and the second described measurements of the fountain pressure in helium II to temperatures down to 0.2°K. From both it could be deduced that helium in superfluid flow does *not* carry the phonon entropy with it, a valuable confirmation of the conclusions previously arrived at more indirectly from velocity of second sound measurements. Unfortunately, the accuracy of existing calorimetric data on the entropy of the bulk liquid is insufficient to allow the deduction from these measurements that the entropy of the superfluid is precisely zero.

Three interesting papers, also on liquid helium II, were given by Vinen and Hall. The first reported measurements of the attenuation of second sound propagated laterally across a rectangular helium-filled tube carrying a longitudinal heat current. The attenuation was found to be proportional to the square of the heat current density, and by observing the time delays in establishing steady values of attenuation after switching the heat current on or off, it was concluded that above a critical velocity the flow of superfluid was turbulent.

The second paper, giving some detail of measurement of rotational frictional forces in helium II, also concluded that rotations of the superfluid result in the appearance of friction of a turbulent character. A similar conclusion that turbulence occurs in superfluid flow at sufficiently high velocities was also noted by Benson and Hallett in their paper describing their work on torsional oscillations of a sphere in helium II.

An elegant test of these conclusions was made by Vinen and Hall. They made second sound velocity and attenuation measurements in a second sound resonator. The resonator, together with its heater and thermometer, was placed in a can of liquid helium, and the *whole assembly* was rotated. On rotation, attenuation that was accurately proportional to the angular velocity was produced. It was concluded, therefore, that the frictional forces within the superfluid responsible for this attenuation are a general property of rotational states of the liquid. By extensions of these and similar experiments, much valuable and new information will be gained concerning the excitations in liquid helium II.

The low-temperature properties of pure liquid He^3 were the subject of much discussion. Extensions of measurements to temperatures as low as 0.23°K were reported by Osborne, Abraham, and Weinstock on the specific heat and by Fairbank, Ard, and Walters on the magnetic susceptibility. This work further supported the conclusions previously reached, not only by these authors, but also by Daunt and Heer, by deVries and Daunt, and by Roberts and Sydoriak, that He^3 does not show a liquid-liquid transition to superfluidity in the temperature range of 0.3° to 2.3°K but that an anomalous specific heat exists that is associated with nuclear magnetic ordering, the maximum of the anomaly occurring between about 0.15° and 0.3°K. The theoretical interpretation of this behavior of pure liquid He^3, which is so different from that of pure liquid He^4, is very interesting and is not yet a completely solved problem. At this conference theoretical proposals toward its interpretation were put forward by many authors, including Rice, deBoer and Cohen, Buckingham, Price, Temperley, and Houston and Rorschach.

Current interest in the effects observable when nuclear spin systems are par-

tially orientated in space was reflected by the presentation of six papers on this subject from five different institutions—Oxford Uninversity, University of Leiden, Ohio State University, Oak Ridge National Laboratory, and the National Bureau of Standards. One of these, on the polarization of In^{115}, by Roberts, Dabbs, and Bernstein was of especial significance in that it reported the direct magnetic polarization of the nuclei in indium metal by an external field. Thin plates of the metal were maintained in a magnetic field of 11,150 gauss at temperatures below 1°K, and a maximum nuclear polarization of about 2 percent was observed to occur at 0.043°K by noting the changes in the transmission of a beam of polarized neutrons.

In a business meeting the conference adopted a resolution recommending that delegates adopt a new temperature scale in the liquid helium temperature region. This new scale, designated T_{55}, is based on a thermodynamic formulation of the vapor pressure of pure liquid He^4 as a function of absolute temperature by van Dijk and Durieux, which was assessed to be correct to within 0.001°K at 1° and within 0.002° at the boiling point and to have the largest possible error of 0.003° at 2.8°K. It was agreed that this thermodynamic formula be used in conjunction with a correction curve proposed by Clement. This correction curve represents the most probable deviations from the formulation to be expected under certain defined methods of experimental measurement of the vapor pressure. Suitable tables embodying this T_{55} scale are being prepared for circulation by van Dijk and Durieux and by Clement, and these will represent a significant advance on the older, T_{48}, scale in its absolute precision. The conference, moreover, agreed that any formal adoption of an international scale of temperature in the helium temperature range be left to the advisory committee on thermometry of the Comité International des Poids et Mesures.

In connection with the measurement of very low temperature, an interesting report was given by Wolf on temperature measurements below 1°K made by Wolf, Cooke, and Meyer. The thermometric substance used was a spherical single crystal of cerium magnesium nitrate, which is known to follow closely Curie's law of paramagnetism to temperatures as low as 0.006°K. The paramagnetic substance for which the absolute temperature determination was required was in the form of a thin spherical layer of powder glued in good thermal contact around the thermometric sphere, and the ensemble was cooled below 1°K magnetically. Since cerium magnesium nitrate is strongly magnetically anisotropic, two simultaneous susceptibility measurements of the composite specimen made along and perpendicular to the axis of the cerium magnesium nitrate single crystal were sufficient to determine the separate simultaneous susceptibilities of the single crystal and of the paramagnetic material under test. These results lead at once to a derivation of both the absolute (T) temperature and the magnetic (T^*) temperature of the test substance. T^* versus T determinations made in this way were reported for iron ammonium alum and neodymium magnesium nitrate.

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Meeting Notes

■ The Vanderbilt University School of Medicine is sponsoring a symposium on the Pharmacology of the Autonomic Nervous System, 8–9 Feb. J. Harold Burn, professor of pharmacology at Oxford University, and this year's Abraham Flexner lecturer, will serve as moderator. The participants in the symposium are Earl Sutherland of Western Reserve University, Robert F. Furchgott of Washington University (St. Louis), Mark Nickerson of the University of Manitoba, David Nachmansohn of Columbia University, Irvine H. Page of the Cleveland Clinic Foundation, and David Grob of Johns Hopkins University.

■ New methods for the prevention of disease in farm animals were discussed at the 56th annual Conference of Veterinarians that was held at the University of Pennsylvania 3–4 Jan. under the auspices of the university's School of Veterinary Medicine. More than 300 veterinarians from a five-state area, representatives of Federal and state agencies, and veterinary leaders from abroad discussed the results of research that is directed toward improving animal health. Twenty-four sessions made up the program. At the annual banquet, Carleton S. Coon, professor of anthropology and curator of general ethnology at the University Museum, was the principal speaker.

"New techniques in virology and their use in veterinary medicine" was the subject of a paper that was delivered by William F. McLimans, research associate professor of microbiology in veterinary medicine at the university. Copper deficiency in cattle was discussed by James A. Henderson of the Ontario Veterinary College, Guelph, Ontario, who described how cattle act when they are on a copper-deficient diet and how to prevent this deficiency.

New findings in air-sac disease among chickens were presented by Palace H. Seitz, poultry pathologist of the Pennsylvania State Bureau of Animal Industry, who led an afternoon session on respiratory diseases of poultry. Goose-stepping pigs that may be so afflicted because of a vitamin deficiency were shown in a film; the causes of the affliction and preventive measures to be taken were discussed in a session that was led by Edward A. Schlif of the Agricultural Research Service, Trenton, N.J.

Other featured speakers were Aage T. Christensen of Copenhagen, Denmark, who considered canine hepatitis, and Floyd Cross, president of the American Veterinary Medical Association and dean of the Veterinary School, Colorado A. and M. College, who spoke on "Rhinotracheitis of cattle." In addition, a panel of four participants discussed "Muzzle disease" of cattle. John Beck, professor of veterinary medicine at Pennsylvania, headed the faculty committee in charge of the conference.

■ Eleven specialists will present papers at the first international symposium on "Food physics: the application of physical principles in food research and production" to be sponsored jointly by Southwest Research Institute and the Institute of Food Technologists in San Antonio, Tex., 15–16 Mar. 1956. Purposes of the symposium are to show the benefits that have come to the food industry through the application of techniques drawn from the physical sciences and to discuss new developments that can be utilized to further advantage.

The contribution of physics to measurement and control will be brought out in reports on methods used in measuring physical properties of dough, crystallization in foods, and the measurement of quality in agricultural commodities. Nuclear magnetic resonance spectroscopy, a method for the rapid, nondestructive analysis of liquids and solids, and vapor chromatography, a technique for the separation and identification of volatile materials in foods, are two new methods that will be described.

How the automatic control of food processes by automation depends on measuring instruments based on physical principles will also be discussed. New methods of preserving and processing foods to be reviewed in the symposium include sterilization with atomic radiation, electrostatic smoking, radiofrequency heating, and processing with ultrasonics.

The technical papers will be followed by a round-table discussion in which all speakers will participate. For further information, write to the general chairman of the symposium, Mr. C. W. Smith, Southwest Research Institute, San Antonio, Tex.

■ The Society of American Military Engineers will hold its second Military Industrial Conference at the Palmer House, Chicago, Ill., 9–10 Feb. The theme of the conference is "National

survival in the nuclear age." The sponsors and cooperating agencies of the meeting believe that an accurate and understandable presentation of nuclear defense is long overdue. The program of the conference is to be presented as a contribution to public understanding of the realities of nuclear warfare and the promise of technology in preventing or ameliorating its effects. For information, write to the Military Industrial Conference, 140 S. Dearborn St., Chicago 3.

■ The American Society for Artificial Internal Organs is soliciting papers for the 1956 meeting which will take place in Atlantic City, N.J., 15–16 Apr. in conjunction with the Federation meetings. Titles and outlines of proposed papers should be sent *by 1 Mar.* to Dr. P. F. Salisbury, 4751 Fountain Ave., Los Angeles 29, Calif.

Forthcoming Events

March

3–4. National Conf. and Workshop on Radio and Television Weather Presentation sponsored by American Meteorological Soc., Hartford, Conn. (K. C. Spengler, 3 Joy St., Boston 8, Mass.)

9–10. Midwest Conf. on Theoretical Physics, Iowa City, Iowa. (J. M. Jauch, Dept. of Physics, State Univ. of Iowa, Iowa City.)

12–16. National Assoc. of Corrosion Engineers, 12th annual, New York, N. Y. (Secretary, NACE, Southern Standard Bldg., Houston 2, Tex.)

14–17. National Science Teachers Assoc., Washington, D.C. (R. H. Carleton, NSTA, 1201 16 St., NW, Washington 6.)

15–16. Food Physics Symposium, 1st international, San Antonio, Tex. (C. W. Smith, Southwest Research Inst., San Antonio.)

15–17. American Orthopsychiatric Assoc., 33rd annual, New York, N.Y. (M. F. Langer, AOA, 1790 Broadway, New York 19.)

15–17. American Physical Soc., Pittsburgh, Pa. (K. K. Darrow, APS, Columbia Univ., New York 27.)

15–17. Kappa Delta Pi, annual, Stillwater, Okla. (E. I. F. Williams, 238 E. Perry St., Tiffin, Ohio.)

16–18. International Assoc. for Dental Research, St. Louis, Mo. (D. Y. Burrill, 129 E. Broadway, Louisville 2, Ky.)

17–18. National Soc. of Professional Engineers, annual spring, Washington, D.C. (K. E. Trombley, NSPE, 1121 15 St., NW, Washington 5.)

18–24. American Soc. of Photogrammetry, annual, joint meeting with American Cong. on Surveying and Mapping, Washington, D.C. (ACSM–ASP, Box 470, Washington 4.)

19–21. Div. of Fluid Dynamics, American Physical Soc., Pasadena, Calif. (F. N. Frenkiel, Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.)

19–22. American Acad. of General Practice Scientific Assembly, 8th annual, Washington, D.C. (AAGP, Broadway at 34th, Kansas City 11, Mo.)

19–22. Inst. of Radio Engineers National Convention, New York. (E. K. Gammett, IRE, 1 E. 79 St., New York 21.)

19–23. American Soc. of Tool Engineers, Chicago, Ill. (H. C. Miller, Armour Research Foundation, 35 W. 33 St., Chicago 16.)

21–22. National Health Forum, New York, N.Y. (T. G. Klumpp, National Health Council, 1790 Broadway, New York 19.)

21–23. American Power Conf., 18th annual, Chicago, Ill. (R. A. Budenholzer, Illinois Institute of Technology, Chicago 16.)

21–24. American Astronomical Soc. Columbus, Ohio. (J. A. Hynek, McMillin Observatory, Ohio State Univ., Columbus.)

23–24. Eastern Psychological Assoc., Atlantic City, N.J. (G. G. Lane, Univ. of Delaware, Newark.)

23–24. North Carolina Acad. of Science, annual, Chapel Hill. (J. A. Yarbrough, Meredith College, Raleigh.)

24–25. American Psychosomatic Soc., 13th annual, Boston, Mass. (T. Lidz, APS, 551 Madison Ave., New York 22.)

24–31. Perspectives in Marine Biology, La Jolla, Calif. (A. A. Buzzati-Traverso, Scripps Institution of Oceanography, La Jolla.)

25–28. American Assoc. of Dental Schools, annual, St. Louis, Mo. (M. W. McCrea, 42 S. Greene St., Baltimore 1, Md.)

25–29. American College Personnel Assoc., Washington, D.C. (Miss C. M. Northrup, Univ. of Denver, Denver, Colo.)

28–3. Colloquium on Frontiers in Physical Optics, Boston, Mass. (S. S. Ballard, Visibility Laboratory, Scripps Institution of Oceanography, San Diego 52, Calif.)

29–31. Pennsylvania Acad. of Science, Indiana. (K. Dearolf, Public Museum and Art Gallery, Reading, Pa.)

29–31. Southern Soc. for Philosophy and Psychology, Asheville, N.C. (J. E. Moore, Georgia Inst. of Technology, Atlanta.)

(*See issue of 20 January for comprehensive list*)