good. Small discrepancies can be explained on the basis of temperature coefficients estimated from data on the similar methanol–benzene system.[4] The large discrepancies at low alcohol concentrations may be the result of experimental errors or from breaking of hydrogen bonds among alcohol molecules for the higher temperature system. The latter alternative is consistent with the results of TFZ.[4]

[1] F. H. Horne, Chemistry Department, Michigan State University, East Lansing, Mich.
[2] A. Beyerlein, thesis, University of Kansas, 1966
[3] S. Whitaker and R. L. Pigford, Indust. Engr. Chem. 50, 1026 (1958).
[4] H. J. V. Tyrrell, J. G. Firth, and M. Zaman, J. Chem. Soc. 1965, 3613.

EB6. Impulsive Heating. I. Theory. B. STEVERDING (introduced by A. H. Werkheiser) and A. H. WERKHEISER, *Redstone Arsenal.*—Electron pulse techniques—as described in the following paper—were used to study the impulsive deformation behavior of metal foils and wires. It was observed that thermomechanical shocks yield a bending moment which is opposite to the bending moment exerted by slow absorption of energy. A theory is developed how longitudinal shock waves generate plastic deformation, which is in good qualitative and quantitative agreement with experimental results. In order to determine the intensity of the shock wave the absorption law for electrons in copper were obtained by Monte Carlo calculations. However, in order to obtain analytical results an approximative "stopping power" formula was used. The passage of the shock waves through the material produces stresses and bending moments which may be greater than the yield strength in certain heated regions of the sample cross section. The permanent plastic deformation generated in this manner is predicted and radii of curvature are calculated. The greatest possible error in the results is introduced by using an estimated value for the yield strength for shock conditions.

EB7. Impulsive Heating. II. Experimental. A. H. WERKHEISER and B. STEVERDING, *Redstone Arsenal.*—The theory presented in the previous section was tested experimentally by subjecting strips of copper foil to an electron beam whose fluence ranged from 1 to 100 cal/cm^2. The electrons in the beam were accelerated to 2 MeV to maximize energy deposition in the copper. Energy deposition occurred in a pulse period of approximately 30 nsec. 3 thicknesses of copper foil were used: 10, 20, and 30 mils. The upper range of fluence was sufficient to fracture all specimens. Lower fluences produced measurable curvature. The direction of curvature was as predicted: concave in the direction of flux. The radii of curvature, with a few exceptions, were approximately that predicted by theory. In general the radius of curvature decreases with fluence and increases with foil thickness.

EB8. Air–Water Diffusion Coefficient from Measurements near Ice Samples.* D. H. MARTIN (introduced by R. R. Patty) and P. W. KIVETT, *North Carolina State University at Raleigh.*—An experiment involving the study of ice under vacuum conditions is described. Ice samples were placed in a chamber evacuated by a 6-stage steam jet pump with capacity sufficient to maintain total pressures in the low millitorr range. Pressure and temperature gradients in the vicinity of the ice were measured. Evaluation of the appropriate heat flow equations in terms of the above gradients and the transport properties of H_2O–air mixtures leads to a value for the ordinary diffusion coefficient for H_2O–air. This value, although preliminary, is in reasonable agreement with a value calculated by the method of Hirshfelder *et al.*, and with experimental results on other similar gas mixtures quoted in the literature.

EB9. Oscillation of a Globule.* I. D. CULPEPPER (introduced by R. D. Edge) and R. D. EDGE, *University of South Carolina.*—The oscillations of a freely supported liquid globule have been discussed by Lamb.[1] However, no experiments have been reported. To investigate this effect, a spherical globule of analine was deposited by a pipette at the interface between a solution of brine and pure water. The analine had a density intermediate between the 2, and remained suspended. Oscillations were induced using a variety of means, such as by a steel ball, the impetus of a falling drop of water, and a fine wire. A oscillations were recorded by a 16-mm movie camera calibrated against a standard clock. The deviation from the linear theory of the frequency of the 1st-, 2nd-, and 3rd-order modes was investigated as a function of amplitude, and the size of globule and found to be small. The interfacial surface tension was found to be 4.9 dyn/cm. In addition, the velocity of traveling waves excited on the globule was found. The inverse fission process, whereby 2 globules coalesce, was studied. The viscous decay of the oscillations was in good agreement with the theory of Lamb.[1] This technique proved to be a simple and reproducible method of measuring low values for interfacial surface tension.

*This work was supported in part by the National Science Foundation.
[1] H. Lamb, *Hydrodynamics*(Dover Publ., Inc., New York, 1945).

EB10. Electromotive Force Generated by a Centrifugal Field in a Metal Rotor.* J. W. BEAMS, *University of Virginia.*—Theory predicts[1,2] that a small electrical potential is produced by the centrifugal field in a spinning metal rotor. This paper describes an attempt to observe this radial electromotive force in a rapidly spinning Duralumin rotor. The rotor is spun inside of an evacuated metal chamber on a vertical thin flexible metal shaft. The shaft passes through vacuum tight oil glands and is supported and driven by an air supported air driven turbine located below the chamber.[3] The lower end of the shaft spins in a pool of mercury which permits electrical contact with the rotor. Capacity "pick ups" near the periphery and axis, respectively, measure the radial electromotive force generated. Helmholtz coils were used to neutralize the earth's magnetic field. Since a magnetic field parallel to the axis induces a radial electromotive force the coils also were employed to apply magnetic fields of various magnitudes and directions which were used to check the reliability of the measurements. Although the interpretation of the data is complicated by possible variable thermal, contact, and surface electromotive forces, it is believed that an electromotive force produced by the centrifugal field exists.

*Work supported by U.S. Army Research Office—Durham.
[1] H. Robl, Acta Phys. Austriaca 5, 202 (1951).
[2] A. J. Dressler, F. C. Michel, H. E. Roschach, Jr., and G. T. Trammell, Bull. Am. Phys. Soc. 12, 183 (1967).
[3] J. W. Beams, F. Linke, and P. Sommer, Rev. Sci. Instr. 9, 248 (1938).

EB11. A Cylinder Lens for Electron Beams Constructed with Permanent Magnets. J. KRONSBEIN and B. S. THOMAS, *University of Florida.*—A cylinder lens made with 2 small permanent magnets was found to present an easy way to construct a virtual slit for an electron microscope. The magnets were approximately equal in strength, about 12.7 mm long, 3.05 mm wide, and 1.70 mm thick. They were placed side by side with their dipole moments opposed and with a uniform gap produced by brass spacers. The magnetization was about 300 G. The cylinder lens constructed in this way is compared with an electrostatic cylinder lens constructed by Moellenstedt and Dueker in connection with their electron beam diffraction studies. In our experiments beam energies ranged from 20 to 50 keV; below the lower limit no image of the slit could be formed. Reduction in the lens' focusing direction was approximately 10X. Slides will show the components and methods of holding them in place.

EB12. The Foucault Pendulum. L. D. HUFF and A. R. REED. *Clemson University.*—The pendulum is approximately 12 m long and has a period of 7.6 sec. When started with an amplitude of 40 cm the swing is damped to a few centimeter in 2 hours. For continuous demonstration a magnetic drive was built; the pendulum has been swinging since May, continuously; the amplitude remains 37 to 38 cm. For this latitude the plane of oscillation should advance 205° in 24 h; the observed advance is 233° in 24 h. Problems of supporting mechanism, drive, and ellipticity of swing will be discussed.

Invited Papers

EC1. Radiation Damage in Metals. ROBERT CHAPLIN, *Clemson University.* (30 min.)

EC2. Observations of Dislocations in Nearly Perfect Copper Crystals. F. W. YOUNG, JR., *Oak Ridge National Laboratory.* (30 min.)

EC3. Creation of Defects in Ionic Crystals by Ionizing Radiation. J. H. CRAWFORD, JR., *University of North Carolina.* (30 min.)

EC4. Studies of Atomic Migration and Reorientation by Optical Absorption. THOMAS J. TURNER, *Wake Forest College.* (30 min.)

Atomic and Radiation Physics

Invited Papers

ED1. Systematic Trends of Atomic Oscillator Strengths. W. L. WIESE, *National Bureau of Standards.* (30 min.)

ED2. Observed Excitation-Radiation Mechanisms in Field Free, Low Density, Arc Heated, Plasma Flows. W. K. McGREGOR, JR., *ARO, Inc.* (30 min.)

Contributed Papers

ED3. Some Results of Estimation of Energy Levels and g Values of Atoms and Ions by Determination of Parameters.* G. W. CHARLES (introduced by P. M. Griffin), *Oak Ridge National Laboratory.*—It is convenient to express energy levels of atoms in terms of certain parameters. These are of 2 types, namely electrostatic and spin–orbit parameters. In the 2 extremes of coupling, 1 or the other types predominates. Between these extremes lies the case of intermediate coupling. Numerical values of the parameters may be obtained by fitting the theoretical equations to known energy levels, as well as by interpolation and extrapolation from parameters obtained by such fitting. For each calculation, one can determine a transformation matrix which, when applied to the energy matrix, serves to diagonalize it. This transformation matrix may then be applied to determine other quantities, such as g values, in intermediate coupling. Calculations have been performed on the simple configurations p^4, p^5, and p^5s, using the 1604-A computer at Oak Ridge National Laboratory. Details of these calculations will be given, as well as some results obtained thus far on experimentally unknown energy levels or unknown g values.

*Research sponsored by the U. S. Atomic Energy Commission under contract with the Union Carbide Corporation.

ED4. Nuclear Quadrupole Resonance of ^{14}N in Sodium Nitro-prusside.* W. T. P. CHOY† (introduced by P. C. Canepa) and P. C. CANEPA, *University of Florida.*—4 pure quadrupole resonance lines have been detected for ^{14}N nuclei in $Na_2(NO)Fe(CN)_5 \cdot 2H_2O$ by means of the continuous-wave technique. The lines are attributed to the nitrogens in the CN bond on the basis of the resonance frequencies. Detailed assignment of the lines is not yet resolved but at least 2 chemically inequivalent sites are required. The lines have been studied as a function of temperature from 4.2° to 140°K and the temperature dependence of the resonance frequencies carefully measured. Resonance frequencies of the 4 lines are 2.82636, 2.76040, 2.71974, and 2.60190 MHz at 77.5°K, and 2.83304, 2.76882, 2.72384, and 2.608 MHz at 4.2°K. The lines are all narrow and have a width of about 300 Hz between points of maximum slope.

*Work supported by the National Science Foundation.
†Present address: Eastern Kentucky University.

ED5. Determination of Low-Energy Electron Attenuation Lengths in Aluminum.* F. W. GARBER† (introduced by R. D. Birkhoff), R. D. BIRKHOFF, and S. J. NALLEY,‡ *Oak Ridge National Laboratory* and *The University of Tennessee.*—Attenuation lengths are determined for electron energies between 1 and 80 eV. The target consisted of a layer of aluminum evaporated onto a 75-Å layer of anodic Al_2O_3 formed on a bottom layer of aluminum sufficiently thick (> 200 Å) to stop the most energetic electrons used. The Al_2O_3 provides electrical insulation between the top and bottom foils. An electron gun supplies a beam normally incident upon the top foil. Currents in the top and bottom foils are measured with Philbrick P2A operational amplifiers coupled to Vidar 510 integrating digital voltmeter. In order to suppress all secondary electron emission from the top foil into the vacuum, a grid was placed 1 mm from the top foil. This grid is operated at a potential 10 V above that of the cathode. For electrons with energies less than 80 eV or greater than 700 eV, partial penetration of the top foil is obtained. From the region below 80 eV, attenuation lengths may be calculated from the data at depths between 300 and 1000 Å. Values of about 350 Å are found but this value does not represent the true attenuation length because of secondary electron production which enhance the current to the bottom foil.

ANNUAL JOINT MEETING—APS-AAPT

29 January-1 February 1968

Chicago

A GUIDE FOR YOUR CONVENIENCE

THE PALMER HOUSE—Monroe Street near State (Headquarters)

Meeting Rooms

Adams	6th Floor
Crystal	3rd Floor
Grand Ballroom	4th Floor
Monroe	6th Floor
Private Dining Room #14 (AAPT VAC Films)	Club Floor (½ floor up from 4th)
Private Dining Room #17	Club Floor (½ floor up from 4th)
Private Dining Room #18	Club Floor (½ floor up from 4th)
Red Lacquer	4th Floor
State Ballroom	4th Floor
Victorian	Lobby
Wabash	3rd Floor

LA SALLE HOTEL—La Salle Street at Madison (Auxiliary)

Meeting Rooms

Chicago	Mezzanine
Grand Ballroom	19th Floor
Illinois	Mezzanine

ADDITIONAL INFORMATION—Palmer House

AIP Headquarters	Room #9	3rd Floor
Commission on College Physics	Rooms #848 and 856	
Exhibits	3rd, 4th and 8th Floors	
National Science Foundation	Room #828	
Placement Service	7th Floor	
Press	Rooms #7 and #8	3rd Floor
Student Sections	Mezzanine	
Visiting Scientists (AAPT)	Room #5	3rd Floor

SERIES II VOLUME 13 NUMBER 2 • PUBLISHED FOR THE AMERICAN PHYSICAL SOCIETY BY THE AMERICAN INSTITUTE OF PHYSICS • FEBRUARY 1968 • PAGES [illegible]

bulletin

OF THE AMERICAN PHYSICAL SOCIETY

INCLUDING THE PROGRAM OF THE

1968 FEBRUARY MEETING IN BOSTON

26-28 FEBRUARY