PHYSICS

Chairman: CHARLES W. MILLER, Department of Physics
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ABSTRACTS

Progress Report on Radiocarbon Dating at Ball State. JOHN LEPERA and DAVID KOLTENBAH, Department of Physics and Astronomy, and JOHN MEISER, Department of Chemistry, Ball State University, Muncie, Indiana 47306.——The method of radiocarbon dating in use at Ball State University involves, first, the pyrolization of a sample and the conversion of the carbon to acetylene. This is followed by the trimerization of the acetylene to benzene over a vanadium pentoxide catalyst. The radiocarbon activity is subsequently measured in a liquid scintillation counter. The overall yield for the conversion of modern charcoal to benzene has been fair to good. The conversion ratio for several conversions of post-Wisconsin glacial peats has been poor, due primarily to the failure of the catalyzation stage. When commercial acetylene was introduced at this stage, the trimerization produced good yields. The possibility of the presence in the natural peat of contaminants which are adsorbed on the catalyst surface and inhibit the trimerization process is discussed. Investigations of the nature of the contaminants are proposed for neutron-activation, mass spectrographic, and gas chromatographic analysis.

Laboratory Experiments in Nanosecond Fluorescence Spectroscopy. JAMES CUNNINGHAM and TORSTEN ALVAGER, Department of Physics, Indiana State University, Terre Haute, Indiana 47809.——Nanosecond fluorescence spectroscopy of macromolecules has in recent years become an important method in biophysical research. In many instances it may also be suitable as laboratory experiments and student research projects. Some examples will be discussed.

The Role of College and University Physics Departments in the In-Service Training of Physics Teachers. L. GENE POORMAN, Associate Professor of Physics, Indiana State University, Terre Haute, Indiana 47809.—— The author of this paper has interacted with more than half of the physics teachers in Indiana Secondary Schools in the past seven years.

The interaction has been possible through conducting institutes, projects and workshops, and through attendance at professional meetings and school visitations.

Based on the direct contacts made, the need to specify in-service activities is emerging. The paper will concentrate on identifying specific needs and suggesting types of programs needed to enhance the probability of closer cooperation between professional staffs and students in physics classrooms.

Types of requests made by teachers and students will be summarized as validation arguments justifying suggested programs. These requests will also serve as the basis for describing the present status of physics teaching in Indiana Secondary Schools.

The δ Scuti Variable Star HR5329: Preliminaries of a Further Investigation. A. C. WARNER, R. L. PLACE, and P. R. ERRINGTON, Department of Physics and Astronomy, Ball State University, Muncie, Indiana 47306. ——In this paper the observing program employed, method of data reduction, and Barning's (1963) periodgram method of light curve analysis are briefly discussed in relation to the star HR5329 (K Bootis A). Two periods have been reported: $0^d.069$ and $0^d.07306$ by Millis (1966) and Desikachary, Parthasarathy, and Rao (1971) respectively. A UBV photometric program was initiated to determine whether the previously found periodicities are distinct and the possible existence of other including a suggested 16-day beat period.

A Field Emission Electron Gun. J. SWEZ, J. WESTGARD, and A. BARBEE, Department of Physics, Indiana State University, Terre Haute, Indiana 47809.——A field emission electron gun has been designed as the basis for a scanning electron microscope. The results of testing this electron gun are reported here. This electron gun utilizes an axially symmetric lens with an oriented tungsten wire tip as a source of electrons and a defining aperture of 100 microns diameter. The electron gun was fabricated from stainless steel and lava and is housed in a steel bell jar pumped down to a pressure of 10^{-10} Torr. Verification of actual field emission was accomplished with a Fowler-Nordheim analysis of voltage versus current data.[1] A computer program utilizing a graphics display subprogram has been written to analyze such data. It was found that the stability of field emission can be greatly enhanced by proper heating and subsequent remolding of the field emitter tip prior to field emission.

Low Temperature Anomalies in Specific Heat in Carbons and Graphites. S. MROZOWSKI, Department of Physics and Astronomy, Ball State University, Muncie, Indiana 47306.——Whereas the specific heat of good graphite crystals corresponds exactly to theoretical expectations down to the lowest temperatures investigated, interesting anomalies are found when lattice defects are present either due to incomplete graphitization or when they are introduced by neutron irradiation. The coefficients of the linear and of the Debye's cubic temperature terms are strongly modified, and specific heat peaks are observed in the temperature range 0.1-0.8°K. All the evidence indicates that in soft carbons and graphite the appearance of the high temeprature peak (0.6-0.7°K) as well as of most of the changes in linear and cubic terms are caused by the presence of localized electronic spins, the high temperature peak corresponding to an antiferromagnetic phase transition. The evidence

[1] "A Simple Method for Deriving, from Measured I(V) Data, Information on the Geometry of a Field Emission Current Source of Unknown Characteristics" by E. M. Charbonnier and E. E. Martin, J. Appl. Phys. 33,1897 (1962).

for the exchange interaction between the localized and conduction spins will also be discussed.

The Increase in Residual Electrical Resistivity in Pure Cu, Ni, Co and Fe Due to Irradiation by Fast Neutrons and Its Correlation with Electron Scattering Between the s- and d-Bands. C. C. SARTAIN, Department of Physics, Indiana State University, Terre Haute, Indiana 47809.—— Horak and Blewitt[1] at Argonne have measured the increase in the residual resistivity in pure Cu, Ni, Co and Fe when irradiated with 1.3 x 10^{12} fission neutrons per cm^2 to be 116.2, 363.9, 794.6 and 1137.2 nano-ohm-cm. As the number of holes in the d-band increase from zero to one, two and three, each step increases the residual resistivity by about 350 nano-ohm-cm.

It would appear that this increase correlates with s-d band scattering in the metals.

Lithium Precipitation in Fast-Neutron Irradiated Germanium. NIEL BENDSEN and R. COSBY, Department of Physics, Ball State University, Muncie, Indiana 47306.——The kinetics of precipitation of lithium in germanium are known to depend on the number, nature, and geometry of nucleating centers present. Using ultra-high purity germanium as the starting material, the experimental study described here has shown that defect complexes introduced via fast-neutron irradiation serve as nucleation centers for lithium. The manner in which the precipitation kinetics are affected by the presence of the defect complexes is discussed. Through annealing studies, the possibility that lithium precipitation may be used as a tool in the study of disordered regions is examined.

A Sulfur Dioxide Survey for Anderson, Indiana.[1] DAVID DUECKER, Marion College, Marion, Indiana and MIKE GWINNUP, THOMAS LYON, and CHARLES W. MILLER, Department of Physics, Anderson College, Anderson, Indiana 46011.——During July, 1974, a thirty-day survey of the sulfur dioxide content of the atmosphere over Anderson, Indiana was conducted. Huey sulfation plates were exposed at 36 sites over the city during the study. The results of the survey indicate that levels of sulfur dioxide over certain parts of the city may be approachng the national ambient air standards for sulfur dioxide. Also, when the sulfur dioxide results are combined with the pertinent wind data, the resulting pattern corresponds with the expected sources of sulfur dioxide in Anderson.

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[1] This work was supported by the National Science Foundation through its Undergraduate Research Participation program, grant number GY-11210.

[1] J. A. Horak and T. H. Blewitt, J. Nuclear Materials 49,161-180, (1973/74).