

## PHYSICS

Chairman: FRANCES E. THROW, Wabash College

ALLAN MITCHELL, Indiana University, was elected chairman for 1956.

---

### ABSTRACTS

**Science and the Good Life.** FRANCIS E. THROW, Wabash College.—On the technological level science offers freedom from want, from disease and from being a mere beast of burden, and (e.g., by printing) makes available the cultural heritage.

On the intellectual level, it broadens horizons, combats superstition, cleanses religion, stirs up ideas, and predicts consequences of courses of action.

For its own sake it is craftsmanship of mind and brain, a community of the highest standards, a search for truth and perfection, an aesthetically beautiful logical structure, and it has revolutionized man's thinking and outlook.

But since the power for good can always be perverted to evil, virtue and morality are pre-requisite for both the flower and fruit of science.

**Computers and Curricula.** PAUL E. STANLEY, Purdue University.—The importance of automatic computing machines in modern scientific research and engineering is pointed out. The desirability of including some theory and practice of computers in the undergraduate curriculum is contrasted with the problem of how to find time for including this material. A brief treatment of the theory of the analog computer is presented and several examples of computer application are given. Suggestions for integrating such applications into the undergraduate science curriculum are made and some methods of implementing the construction of the equipment on a limited budget are proposed.

**On the Orientational Transitions in Solid  $\text{CD}_4$ .** T. A. KEENAN and H. M. JAMES, Purdue University.— $\text{CD}_4$  shows successive orientational transitions at 22.2°K and 27.1°K. To gain an understanding of their origin, we have considered an analogous system of classical spherical rotators arranged in a cubic close-packed lattice. The assumed coupling between next-neighbor molecules is the dominant term in the coulomb interaction of two charge distributions of tetrahedral symmetry; coupling of more widely separated molecules is neglected. A treatment of this system in the internal field approximation indicates that two types of orientational ordering may exist in such a crystal. At the lowest temperatures the orientational distribution function is the same for all molecules. At higher temperatures the stable type of order is one in which the crystal lattice is divided into eight sublattices, with all molecules on each sublattice having the same characteristic orientational distribution; molecules on two of these sublattices show no orientational ordering. At still higher temperatures the orientational ordering disappears completely. The lower transition is of the first order, the higher of second

order. The predicted ratio of the transition temperatures agrees reasonably well with the observed ratio in  $\text{CD}_4$ , and the actual temperatures and the integrated heats of transition are given satisfactorily when one assumes a reasonable strength for the molecular coupling.

**A  $4\pi$  Beta-ray Scintillation Spectrometer and the Spectrum<sup>1</sup> of Chlorine.**<sup>36</sup> R. G. JOHNSON, O. E. JOHNSON and L. M. LANGER, Indiana University.—A  $4\pi$  beta-ray scintillation spectrometer has been built and tested for reliability. The plastic phosphors used as detectors are shown to be linear from 60 key to 1 Mev. Measurements of the beta spectra from  $\text{W}^{185}$ ,  $\text{P}^{32}$ ,  $\text{Y}^{91}$ , and  $\text{Tl}^{204}$  are in good agreement with the results of magnetic spectrometer measurements.

The beta spectrum of  $\text{Cl}^{36}$  has been measured with sources having an average thickness of 9 and 19 micrograms/cm<sup>2</sup>. Using the theoretical shape factor for the linear combination of the Scalar and Tensor interaction forms, limits are obtained for the values of the ratios of matrix elements,  $A_{ij}/T_{ij}$  and  $R_{ij}/T_{ij}$ . The best fit to the data is for  $A_{ij}/T_{ij} = 14.2$  and  $R_{ij}/T_{ij} = 0$ .

**The "Shapes" of Beta Spectra.** O. E. JOHNSON, R. G. JOHNSON<sup>2</sup> and L. M. LANGER, Indiana University.—The momentum distributions of the negatron decays of  $\text{Y}^{90}$  and  $\text{In}^{114}$  have been precisely measured using thermally evaporated sources. Analysis of the experimental data in a manner consistent with beta decay theory as presently interpreted yields Fermi-Kurie plots which show apparently real, but slight, deviations from linearity. These deviations can be accounted for by Fierz interference between the Tensor and Axial Vector forms.

**A Search for Double Beta Disintegration of  $\text{Nd}^{150}$  and the Nature of the Neutrino.** L. M. LANGER, Indiana University.—Using large scale liquid scintillator techniques, a search was made for the transformation of  $\text{Nd}^{150}$  into  $\text{Sm}^{150}$  with the simultaneous emission of two electrons. A definitive negative result has been obtained which indicates that, if such a transition occurs with the net emission of no neutinos, the mean life for the process must be greater than  $10^{18}$  years. Since this is much longer than what one expects theoretically, even under the most unfavorable conditions, one is led to the conclusion that the neutrino and anti-neutrino are not identical, i.e., they are Dirac rather than Majorana particles.

---

1. Supported by the joint program of ONR and the AEC, and by a grant from the Research Corporation.

2. Supported by the joint program of ONR and the AEC, and by a grant from the Research Corporation.