PHYSICS

Chairman: R. T. Dufford, Evansville College
Paul Bender, Goshen College, was elected chairman for 1963

ABSTRACTS

Angular Distribution of Alpha Particles Scattered by Carbon as a Function of Energy. Richard A. Atneosen and Howard L. Wilson, Indiana University.—The elastic and inelastic scattering of α particles by carbon has been observed at bombarding energies of 20.16, 20.46, 20.91, 21.20, 21.62, 21.90, 22.48 and 22.73 Mev. Angular distributions have been extracted for the groups corresponding to elastic and inelastic excitation of C^{12} to the 4.43 Mev level in order to study a previously reported anomaly at 21.85 $\pm$ .1 Mev. The elastic distributions have a pronounced diffraction structure which varies slowly with energy at the forward angles but shows an anomalous behavior at the back angles. The 4.43 distribution qualitatively obeys the Blair phase rule at the forward angles.

The Beta Decay of Carbon 10 and the Cluster Model of the Nucleus. F. J. Bartis, Indiana University.—A new toroidal spectrometer has been used to determine an end point of 1865$\pm$15 keV for the main positron branch from the decay of C^{10}. Also, the half-life of C^{10} was found to be 19.27$\pm$0.08 sec. The C^{10} end point, together with previous work on the mass-10 nuclei, leads to 4.61 MeV for the Coulomb energy difference between C^{10} and Be^{10}. According to the cluster model of Wildermuth and Kanellopoulos, this Coulomb difference is just the electrostatic energy of the diproton cluster in C^{10}. In order to obtain a lower bound on the size of the diproton, we have used the deuteron cluster in Li^6 which has been cited to explain the 2.80-f charge radius of Li^6. Using a cluster model wavefunction and an approximate method suggested by Thieberger, we calculated 3.52 MeV as an upper limit on the C^{10}-Be^{10} Coulomb energy difference. Hence, we conclude that the cluster model is inconsistent with experimental evidence in its description of the spatial properties of these nuclear clusters.

A Study of the Splitting of the Nuclear Quadrupole Resonance Lines of Certain Nuclei in a Weak Zeeman Field. Kenneth S. Robinson, Oakland City College.—Single crystals of sodium chlorate, paradichlorobenzene, and cuprite were subjected to bursts of rf energy at their resonance frequencies, and the resulting absorption lines were viewed on the screen of an oscilloscope. Stereographic plots of the splitting pattern in a 10 to 20 gauss field were made, and the field gradient orientations in a unit cell of the crystal deduced from this splitting pattern. These results were compared with similar results obtained from x-ray diffraction, and with results of nuclear quadrupole resonance work carried out in much stronger fields by Dean, Bersohn, Williams, and others. The

magnetic moment of the chlorine-35 nucleus was computed from the splitting data.

Beer's Law with a Limited Detector. HAROLD K. HUGHES, Indiana State College.—The exponential law for the absorption of radiation and of particles passing through matter is applied to the measurement of cross sections and to the determination of concentrations in analytical spectroscopy. In these applications it is desirable to choose the uncommitted experimental parameters so as to achieve the maximum sensitivity to changes in cross section or concentration. With a linear detector, the optimum transmittance is generally 1/e or 36.8%. With a limited detector, however, the transmittance should be quite different and may be as low as 2%.

Shape of the $O^+ \rightarrow O^+$ Positron Spectrum in Ga^{66}. D. C. CAMP and L. M. LANGER, Indiana University.—A detailed study of the beta spectrum of Ga^{66} with emphasis on the shape of the positron spectrum of the $O^+ \rightarrow O^+$ transition has been made with a magnetic spectrometer. The ground state to ground state transition is found to have a nonstatistical shape. The shape factor is fitted by the equation $S(W) = K(1 + 0.0328W + 0.354/W - 0.000419W^2)$ where the numerical coefficients are explicitly determined by the value of the ratio of the nuclear matrix elements, $\lambda = \frac{<i\alpha \cdot r>}{<1>} = -21.3$. An additional factor of the form $(1 + 0.4/W)$ is needed to obtain the best fit. The nonstatistical shape for this group leads to an endpoint energy of 4.153 ± 0.003 MeV and an intensity of 51.2 percent. The abnormally high comparative half-life ($\log ft = 7.903$) can be attributed to the difference in isotopic spin between the initial and final states. The resultant strong depression of the nuclear matrix element $<1>$ makes it meaningful to include in the theoretical shape factor the effect of the usually neglected matrix element $<i\alpha \cdot r>$. From the shape measurement and the determination of the comparative half-life, it is found that the amount of $T = 3$ admixture in the $T = 2$ ground state of Ga^{66} is 4.00×10^{-5}.

Determination of Nuclear Matrix Elements in the Non-Unique First Forbidden Beta-Decay of Eu^{152}. K. S. R. SASTRY, Indiana University.—Nuclear matrix elements governing the non-unique once forbidden 1485 kev outermost β-transition in the decay $Eu^{152} \rightarrow Gd^{152}$ have been determined using our β-γ directional correlation data, the β-circularly polarized γ-ray correlation measurements of Berthier and of Alexander and Steffen and the β-spectrum shape results of Langer and Smith. Values of the individual matrix elements obtained from this analysis will be presented and their significance will be discussed.