

PHYSICS

Chairman: EDWIN C. CRAIG, Ball State University
RICHARD CONKLIN, Hanover College, was elected chairman for 1969.

ABSTRACTS

Preliminary Results of a Muon Energy Study. ROBERT CALLIS and EDWIN CRAIG, Ball State University.—This study was conducted in order to determine the energy of muon particles observable through liquid scintillation detection when muon travel was limited to a short distance. Knowing the time delay necessary for each path of electronic signal to achieve coincidence, and the distance of muon flight between scintillation tanks, the muon velocity can be calculated. Knowing the muon velocity, and the mass as $206 m_e$, the energy of the muon can be determined.

The coincidence system used in this study included time to height conversion and had a resolving time of 20 nanoseconds. With the calibrated nanosecond delay module it was possible to introduce delays in increments of one nanosecond. The average muon velocity was calculated to be 2.18×10^8 m/sec. The energy corresponding to this velocity was 40.5 MeV. The probability of chance coincidence occurring was 2.76×10^{-5} based upon a probability certainty of 1.00. The average number of chance coincidences occurring in one second was found to be 9.94×10^{-5} counts/sec.

Determination of Absolute D^* for Photovoltaic, Infra-red Detectors. JOHN F. HOULIHAN, Shenango Valley Campus, Penn State University.—A practical and accurate method of determining an absolute value of D^* for photovoltaic, infra-red detectors is discussed. The D^* performance parameter is defined and is expressed in physically measurable quantities. The experimental set-up is shown and discussed briefly. Also the correction factors which are necessary due to the experimental techniques used, are considered in some detail and practical methods of determining them are given. A Fourier analysis of a square-wave pulse-train is presented in an appendix and the affect of such a wave train on an rms meter considered in detail. Finally, several excellent reference sources for infra-red detector work are listed.

Possible Methods for Observing Shadow Bands at the Next Solar Eclipse in North America. ROGER D. BURGESS and MALCOM HULTS, Ball State University.—Immediately preceding and following an eclipse of the sun, light and dark bands are often seen moving across the surface of the earth. A great deal more study of these so-called Shadow Bands, both theoretical and experimental, is needed. This paper reviews the history of observations of the bands and the attempts to explain them. A report of an observation of the bands in Rio Grande do Sul, Brazil, November 12, 1966, is given. More advanced methods of visually observing the bands are suggested and attempts to detect and measure shadow bands electronically are reported. The presentation emphasizes the importance

of both visual observation and electronic detection of shadow bands at the next eclipse March 7, 1970, which is readily accessible to physicists and astronomers in North America.

Nuclear Electric Quadrupole Resonance Analysis of Chemical Bonds in Cl^{35} -Containing, Straight-Chain Hydrocarbons. DAVID E. KOLTENBAH, Ball State University.—The nuclear electric quadrupole moment of nuclei of spin greater than or equal to unity interacts with the electric field gradient arising from the molecular or crystalline electric field in the environs of the given nucleus. The frequency of this interaction is sensitive to changes in the surrounding electron distribution arising from an altered chemical structure. Consequently, the nuclear quadrupole resonance (NQR) frequency is related to the structure of the chemical bond, and the study of the shift of this frequency from one member to another in a homologous group of compounds has been employed as a means of studying chemical bonds. Extensive investigations are reported in the literature in which this effect has been studied in halogenated ring and halogenated saturated straight-chain compounds. This paper reviewed a systematic study of NQR frequencies of Cl^{35} in several chloroalkenes, of which virtually no previous study had been made. The inductive effect of $-\text{Cl}$, $-\text{CClH}_2$, and $-\text{CH}_3$ substituents upon the electron density of the C-Cl bonds was determined. The effects of hybridization and π -bonding characteristics were estimated by the Townes-Dailey rules, and the C-Cl bond ionicities were calculated and compared with the ionicities of more abundantly studied chloroalkanes.

Low Energy Elastic Scattering of K-Mesons off Protons. GERALD P. THOMAS, Ball State University.—Forty-four K^- -p low momentum elastic scattering events between 0 and 250 MeV/c have been found by following 265.12 meters of K-meson tracks, backward from their capture points in nuclear emulsion. The total scattering cross-section is plotted as a function of kaon momentum and this is fitted with the s-wave zero-effective-range theory with the scattering lengths $A_0 = -1.1 + 0.55i$, $A_1 = -0.20 + 0.44i$ for the isotopic spin $T = 0$ and $T = 1$ channel respectively. Further evidence for s-wave interaction is discussed through the angular distribution in the center-of-mass system for the elastic events.