

PHYSICS

Chairman: ALLAN MITCHELL, Indiana University

MALCOLM CORRELL, DePauw University, was elected chairman for 1957

ABSTRACTS

Determination of Masses from Disintegration Energies as Measured by Beta- and Gamma-Ray Spectra. ALLAN C. G. MITCHELL, Indiana University.—Mass differences can be measured very accurately by means of total disintegration energies determined from beta- and gamma-ray spectra. In general, mass differences can be determined by this means with an accuracy of a few kilovolts while reaction energies and mass spectrometer differences can only be given with errors of the order of tens of kilovolts. Various coincidence techniques are discussed which are helpful in determining the total disintegration energy and examples are given. Mass differences of stable isobars, determined with the help of radioactive species which undergo both beta-ray and positron emission, are compared with similar results obtained by mass spectroscopic means. Some corrections to the table of total disintegration energies are given.

Some Novel Orientations of Dipole Fields. MALCOLM CORRELL, DePauw University.—Two dimensional illustrations of dipole fields usually have the dipole axis parallel to the plane of projection. Projected field line configurations are to be shown for cases where the dipole axis is not parallel to the plane of projection.

Magnetic Fields Suggested by Solar Prominence Streaming. MALCOLM CORRELL, DePauw University.—Solar Prominences are frequently characterized by streaming motions along paths which suggests magnetic field configurations. Several attempts to fit idealized field patterns to such streamers are to be reported.

Comparison of a Vacuum Trajectory with an Actual Trajectory. EARL MARTIN, Hanover College.—Using the theoretical equations for the motion of a particle in a uniform field of force its path is determined. From the results of a great many firings of large guns of various calibers tables have been set up and empirical equations found which express the values given in the tables. A curve is plotted from these equations which shows the actual path of the projectile.

Scattering of 19-Mev Alpha Particles by Ne, Al, A, and Cu.¹ E. BLEULER, O. GAILAR, L. SEIDLITZ, and D. J. TENDAM, Purdue University.—The elastic and inelastic scattering of 19-Mev alpha particles by Ne, Al, A, and Cu were measured from 12° to 170°. Photographic plates, spaced every 2.5°, were used for the gases, a rotating counter

¹Supported in part by the U. S. Atomic Energy Commission.

telescope for the metals. The r.m.s. deviations of the scattering angles from the mean values were of the order of 0.3° . The scattering patterns from the ground state and the first excited state of Ne show nearly equidistant minima and maxima. Assuming a square-well nuclear potential and using the Born approximation one obtains interaction radii of 6.4 and 6.7×10^{-13} cm, respectively. The angular distributions from the second, third, and fourth level are irregular and don't permit a simple interpretation. The scattering patterns from A are similar and correspond to a radius of 6.9×10^{-13} cm. From the elastic scattering by Al a radius of 6.4×10^{-13} cm is calculated, whereas at 40 Mev a value of 5.4×10^{-13} Mev has been found. The difference probably indicates a failure of the Born approximation; accurate calculations, with a view to determine the optical-model parameters for the alpha-nucleus interaction, are in progress elsewhere. No simple analysis has been tried yet for the elastic scattering by Cu and the inelastic-scattering patterns from Al and Cu which show large but irregular fluctuations.

The Integral Equations for the Transition Matrices in the Static Meson Theory.¹ NOBUYUKI FUKUDA and JULIUS KOVACS, Indiana University.—The Chew-Low-Wick integral equation for the scattering matrix in the static meson theory has been generalized so as to make it possible to treat the various pion processes in which arbitrary numbers of pions are involved. Such a generalization is also necessitated if one wants to take into account the contribution of two or more meson configurations in pion-nucleon scattering. The outgoing or incoming wave functions corresponding to the many-meson initial states are defined in the same manner as by the above-mentioned authors in the one-meson problem, and are shown to be identical with those introduced by Lippmann and Schwinger. An approximate expression for the two-meson production matrix is obtained and some correction terms due to this production are derived for Chew Low one-meson equation.

The Beta Decay of Tb^{161} . W. G. SMITH, J. H. HAMILTON, R. L. ROBINSON, and L. M. LANGER, Indiana University.¹—The radiations emitted in the beta decay of 7 day Tb^{161} have been studied with a 180° , 40 cm. radius of curvature, shaped magnetic field spectrometer and a scintillation counter. Gamma-gamma coincidence measurements have also been made. The following transitions with multiplicities indicated were observed (energy in kev): 25.5(EL), 48.9(M1), 56.9(EL, tentative), and 74.6(EL). The following beta groups were also observed (energy in kev): 571, 522, 496, and 439. A level scheme incorporating these data is presented.

¹Supported by the National Science Foundation and the Joint Program of the ONR and the A.E.C.

¹Support by the joint program of the U. S. Office of Naval Research and the U. S. Atomic Energy Commission, and by a grant from the Research Corporation.

Intersecting Beam Accelerator With Storage Ring.¹ D. B. LICHTENBERG, R. G. NEWTON and M. H. ROSS, Indiana University.—Much higher energies are available for the study of nuclear phenomena if two beams of particles traveling in opposite directions are made to intersect rather than letting one beam strike a stationary target. Instead of building two separate accelerators to shoot particles at each other, it may be preferable to inject the beam from a single accelerator into a storage ring. The beam would then circulate in the storage ring at high energy until another beam was accelerated, at which time the two beams would collide. The principal difficulty is that of achieving high intensity beams so that there will be a sufficient number of collisions to be able to do accurate experiments. Liouville's theorem sets a limit on the intensity that can be achieved and leads to the requirement that the particles be transferred from the accelerator to the storage ring with high efficiency. A magnetic device known as the regenerative deflector shows promise of being able to accomplish this.

Forces Between Strange Particles and Nucleons.¹ MARC ROSS and D. B. LICHTENBERG, Indiana University.—It is found experimentally that the heavy strange particles—hyperons—interact strongly with nucleons. A model has been adopted which assumes that Π -mesons are responsible for this strong interaction. In addition, it is assumed that the spin of the hyperons is $\frac{1}{2}$, the same as the spin of the nucleons, and that the Σ and Λ hyperons have the same parity. With these assumptions and several mathematical approximations, the forces between hyperons and nucleons have been calculated. There is one free parameter in the calculation which is fixed by comparison with experiment. The calculation predicts that the forces between the Λ hyperon and nucleon are highly spin dependent and that the forces between the Σ^+ hyperon and proton are relatively weak compared to the Λ -proton forces.

On Ghost States in Field Theory.¹ ROGER G. NEWTON, Indiana University.—Since the discovery by Källén and Pauli that the simple model field theory of T. D. Lee for the interaction of three kinds of particles contains physically undesirable bound states whose occupation probability is negative, real field theories such as quantum electrodynamics have been suspected of the same fault. The evidence, although inconclusive, seems to show that electrodynamics has indeed similar properties. We are investigating the question from the point of view of the conventional expansion in powers of the fine structure constant. It then appears that even in the lowest approximation several different electron masses occur, not all of which have real positive probability.

¹Supported by the NSF.

¹Supported by the NSF.

¹Supported by NSF.