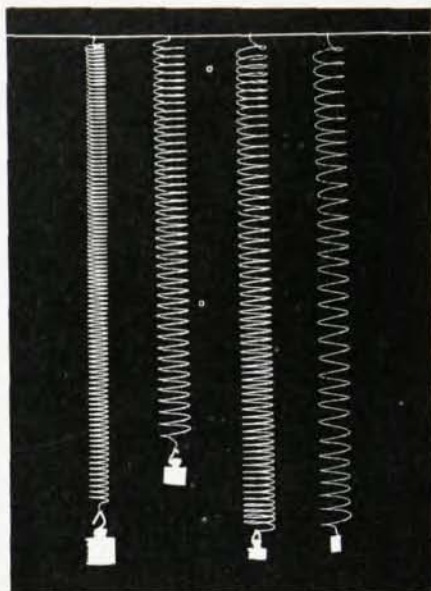


## QUARTZ SPRINGS

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lems such as the problem of the diffraction of electromagnetic waves at the edge of a semi-infinite perfectly conducting screen, for which the theory was developed by Sommerfeld in 1896. Fair agreement was obtained with optical measurement, though it was found that the thickness of the screen and irregularities of the edge in terms of the wavelength, and the material of the screen, had appreciable effect on the measurements.

Comparison between theory and experiment was obtained by measurements of the diffraction pattern of a radar wave of particular wavelength for a rectangular copper screen. The field is measured by rotating a small bisectoral horn in a complete circle about various points along one edge of the screen. Excellent agreement is obtained between theoretical and experimental patterns throughout the range of measurement. In the geometrical shadow, variations from theory indicate diffracted energy from the other three edges of the screen: thus the screen dimensions are not large enough to give complete agreement with the classical theory. On the other hand, such experimental patterns aid in the study of the use of radar waves for the detection and guidance of missiles, where finite diffracting areas are encountered. C.W.H.

On the Diffraction of Radar Waves by a Semi-Infinite Conducting Screen. By C. W. Horton and R. B. Watson. *J. App. Phys.*, 21:15, January, 1950.

### Meson Decay

The instability of the meson that constitutes a large fraction of the cosmic radiation at sea level has been experimentally established for ten years, and the light charged decay particle that was observed provided a means of directly measuring the mean lifetime—2.2 microseconds—for the process. Only recently, however, has some light been thrown on the nature of the decay process, and on the identification of the decay products. The energies of the charged decay particles first reported seemed conflicting, while the discovery that this meson is not the particle postulated by Yukawa to account for nuclear forces and beta decay left no theoretical guidance in the problem.

In the present work the nature and energy of the charged decay particles was studied by observing their penetration through different absorbers. Trays of Geiger-Müller counters with circuits that recorded delayed coincidences were used. It was found that the absorption curve exhibits two components, one of which may be attributed to light charged particles having energies up to about 50 Mev, while the other, which is much more penetrating, was demonstrated to be due to bremsstrahlung from the charged particles. The intensities of the bremsstrahlung were compared when the charged particles were absorbed in light and heavy elements, and showed that these particles are almost certainly electrons. The actual form of the electron energy spectrum could not be deduced, but it is clear that in a large fraction of disintegrations the electron has an energy between 25 and 50 Mev.

These results are in agreement with other recent data, particularly those obtained by Steinberger from a simi-

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lar absorption experiment, and by Leighton, Anderson and Seriff, and by Thompson, who made many accurate momentum measurements of the decay electrons with cloud chambers. They are also consistent with the currently popular idea that each decay process results in an electron and two neutrinos.

E.P.H.

On the Disintegration Products of the 2.2  $\mu$ sec. Meson. By E. P. Hincks and B. Pontecorvo. *Phys Rev.* 77:102, January 1, 1950.

### Acoustical Anisotropy

The anisotropy of an acoustic medium gives rise to several interesting phenomena. For any given direction there are in general three possible modes of sound propagation. The particle displacements for these modes are mutually perpendicular, but these displacements are not necessarily perpendicular or parallel to the wave normal, as is the case for purely compressional and transverse modes. The modes are so coupled that energy transfer may occur following a normal reflection (as well as for other angles as in the case of isotropic solids). The energy does not in general travel in a direction normal to the wave front and thus one observes a phenomenon analogous to optical birefringence.

In the investigation reported here all these effects were observed. Rectangular single crystals of ammonium dihydrogen phosphate (ADP) and potassium dihydrogen phosphate (KDP) constituted the anisotropic media. For each a complete set of elastic constants were obtained using a pulsed ultrasonic technique. With a carrier frequency of 10 megacycles per second and a pulse length of about 3 microseconds, single crystal specimens, an inch or two on an edge, present essentially an infinite medium to the sound waves. It was possible to calculate the directions of propagation of all three modes and to check against experiment. For a particular direction of propagation in ADP an anomalously large beam spreading was predicted and observed. The pulsed ultrasonic technique is in many ways well suited to the investigation of the elastic properties of small specimens and is particularly useful in demonstrating these phenomena peculiar to acoustically anisotropic media.

W.J.P.

Acoustical Properties of Anisotropic Materials. By W. J. Price and H. B. Huntington. *J. Acous. Soc. Am.* 23:32, January, 1950.

### Exchange

Recent high energy experiments on the scattering of neutrons by protons support the theory that the fundamental nuclear force between these particles is of the "exchange type." An elementary, nonmathematical discussion is given of what is meant by such exchange forces. Their anomalous behavior when viewed classically is shown to appear more natural when the wave aspects of the elementary particles are taken into account as required by the quantum theory. The evidence about nuclear forces which led to the prediction of exchange of forces long before an experimental test was possible are summarized. Finally, the role of the meson in accounting

for the nuclear force is sketched and illustrated with various neutron-proton reactions involving the emission of mesons.

D.L.F.

Exchange Forces. By David L. Falkoff. *Am. J. Phys.* 18:30, January, 1950.

### Image Formation

According to the reciprocity law of photochemical reactions, the photoproduct produced is dependent only upon the product of light intensity and exposing time, and is independent of either of these factors separately so long as they are varied reciprocally. The photographic process does not obey the law, there being one intensity level for which a given exposure produces a maximum effect, the effect declining at either higher or lower intensities. It is now generally believed that the low-intensity reciprocity-law failure in photographic exposure is due to instability of the latent image speck when it starts to form due to thermal motion. Experimental evidence indicates that the latent image is built up in a series of steps individually initiated by successive absorptions of light quanta. The quanta produce free photoconductivity electrons in the photographic grains that diffuse through the crystal to pre-existing sensitivity specks capable of trapping the electrons. For each electron trapped, a silver ion migrates to the speck to form a silver atom. It appears that after a certain number of these steps, the photoproduct speck attains a critical size that is stable, but not yet developable. Thus, the formation of a stable sublatent image at low light intensities is inefficient because there is more time for the speck to evaporate before it reaches its critical size.

Experimental results are given to show that the energy depth of the traps for the initially trapped electrons in latent image formation can be determined from measurements of reciprocity-law failure at different temperatures. The average value for the energy depth is found to be of the order 0.75 ev. The present paper is concerned principally with a theoretical interpretation of the results as they are related to the exposure required to establish the stable, but not developable, sublatent image. It can be said at once that at least two quanta must be absorbed by a grain in a certain critical time element,  $\tau$ , to establish the stable subspeck. Using probability formulas, theoretical reciprocity curves are calculated based on the requirement that, in general, a multiplet,  $s$ , of quanta must be absorbed in the critical time,  $\tau$ , to form the stable subspeck. The calculation leads to the conclusion that the slope of the reciprocity curve at low intensities approaches the value  $-(s-1)$ . A comparison of the slopes of the theoretical and experimental reciprocity curves at low intensity then affords a method of determining the value of  $s$ . Experimental slope values for reciprocity curves would indicate that  $s$  has the value 2.

J.H.W.

Low-Intensity Reciprocity-Law Failure in Photographic Exposure: Energy Depth of Electron Traps in Latent-Image Formation; Number of Quanta Required to Form the Stable Sublatent Image. By J. H. Webb. *J. Opt. Soc. Am.* 40:3, January, 1950.