



JOURNAL

NOTES

Magnetic Poles

One of the most striking features of atomic physics is the fact that electricity always occurs in integral multiples of a quantum of electricity, the electronic charge. This feature has so far received no explanation. All the existing theories of electrodynamics, whether classical or quantum, allow of arbitrary values for the charges on particles. A possible way of escape from this deadlock is provided by the assumption that particles with single magnetic poles can exist. One can formulate consistent equations of motion for a particle with a pole of given strength in interaction with a charged particle according to the principles of quantum mechanics only provided the charge is an integral multiple of a certain charge, which is a function of the pole strength, Planck's constant, and the velocity of light. This charge we may take to be the electronic charge.

A particle with a single pole has never yet been observed. This is rather to be expected, since the pole strength which fits in with the observed value of the charge on the electron is very large, so that one would need an extremely large energy to separate this pole from its equal and opposite pole and so create a pair of particles, each with individual poles of opposite sign. With the large energies now becoming available for atomic experiments one may hope that single poles will reveal themselves in the future.

The present paper shows how the complete set of equations needed to describe particles with poles interacting with charged particles may be obtained from an action principle. The action integral is a multivalued function of its variables and one can get the required mathematical condition by putting the uncertainty in the action integral equal to an integral multiple of Planck's constant—a procedure which corresponds to the method of quantization of Bohr's theory.

P.A.M.D.

The Theory of Magnetic Poles. By P. A. M. Dirac. *Phys. Rev.* 74: 817, October 1, 1948.

Polarized Headlights

Possibly the greatest single hazard to night driving is the blinding glare a driver suffers when meeting another car. Eliminating this glare by using polarizing headlights and windshields was proposed as early as 1920. This proposal, and all later proposals, have involved either circular or linear polarizers at forty-five or ninety degrees to the vertical. In this paper the authors discuss both the early specific systems and the general polarized headlight system, in which any variety of elliptical polarizer

is placed at any orientation over the headlight and the corresponding analyzer is properly positioned on the windshield. It is shown that although all the systems extinguish the opposing headlights, they differ markedly in other characteristics such as relative transmission of daylight glare, transmission of light reflected from various objects, and contrast between objects and the road. This last characteristic has special significance for driving safety. People's clothes and road surfaces do not show the same contrasts in reflecting polarized light as they do in reflecting unpolarized light. It is because of these differences that the contrast between a person and the road in a polarized light headlight system depends on the type and orientation of the polarizer. Thus it is possible, in an unpolarized system, to have zero contrast whereas the same situation in a polarized system will have a contrast that is clearly discernible. A table is shown in which the characteristics of six different polarized headlight systems are compared. Polaroid Corporation, after consideration of these criteria, is now using for its performance demonstrations an inclination of the viewer polarizer minus thirty-five degrees from the vertical. B.H.R.

A Comparative Survey of Some Possible Systems of Polarized Headlights. By B. H. Billings and E. H. Land. *J. Opt. Soc. Am.* 38: 819, October 1948.

Geologic Age

Radioactive decay has been used to estimate the age of rocks, by measuring the percentage of uranium in the rocks that had decayed into helium and lead. A new radioactivity measure of geologic age may be at hand. Naturally radioactive potassium has long been known to decay, upon emitting an electron, to form calcium. The high abundance of a heavy stable isotope of argon of about the same atomic weight as potassium has been taken by some as evidence that potassium also decays into argon by capturing an electron, a view strengthened by the fact that x-rays are emitted by potassium. The first direct evidence to support this hypothesis is found in the present research in which an isotopic analysis of the argon from four old potassium minerals was made. In each case a very definite excess amount of argon was measured.

It was calculated that approximately six percent of the potassium atoms decay to form heavy argon. The correlation between the amount of argon detected and the age of the mineral is good enough in these preliminary experiments to indicate that when the time of decay and the ratio of decay products of radioactive potassium are known with more certainty the exact potassium and heavy argon content of a mineral will furnish a new measure of its geological age. A.O.C.N.

Argon 40 in Potassium Minerals. By L. T. Aldrich and Alfred O. Nier. *Phys. Rev.* 74: 876, October 15, 1948.

Rockets and Meteorites

Rockets may possibly be made fast enough to reach equilibrium with the earth's gravitational field and re-

volve about the earth as satellites or to escape the earth entirely and travel in interplanetary space. The thin metal skin of such a rocket would be exposed to meteorite impact for relatively long periods of time. This paper describes a preliminary attempt to estimate the probability of a meteorite hit and the amount of penetration by meteorites of different sizes if a hit should occur.

It is found that for meteorites large enough to present a perforation hazard the probability of a hit is negligibly small, particularly if the time interval considered is not excessively large. Further improvements in the results would require more accurate data of meteorite frequency as a function of size, a more accurate theory of the penetration of metal plate by small, high speed particles, and a consideration of the effects upon the penetration process of the heat generated during impact. G.G.

Probability that a Meteorite Will Hit or Penetrate a Body Situated in the Vicinity of the Earth. By G. Grimmer. *J. App. Phys.* 19: 947, October 1948.

Infrared Detector

Since infrared or heat radiation of wavelength longer than about one micron cannot be detected by visual or photographic means, physicists, besides pushing development of standard radiation detectors such as thermopiles and bolometers, have roamed far afield in their attempts to find new and more sensitive infrared detectors. One of the far fields they have been exploring is low temperature phenomena. Superconducting bolometers have been developed recently in the Johns Hopkins Cryogeny Laboratory. (A superconductor is any substance that suddenly loses all its resistance when cooled down close enough to absolute zero.) A strip of the superconductor columbium nitride is cooled by liquid hydrogen to about fourteen degrees absolute and held at the center of the one-twentieth-degree temperature interval in which its transition from normal (i.e., about one ohm) to zero resistance takes place. Properly connected in an electric circuit and exposed to minute quantities of radiation, it becomes an extremely sensitive resistance thermometer.

This paper describes the superconducting bolometer's sensitivity and compares it with that of other radiation detectors. Not only is its sensitivity outstanding but its low temperature characteristics also make it unique as a tool for examining the as-yet-unexplored field of emission spectra from materials at room temperature, a field which may have important uses in biological analysis. N.F.

The Infrared Sensitivity of Superconducting Bolometers. By Nelson Fuson. *J. Opt. Soc. Am.* 38: 845, October 1948.

Crystal Defects

A simple ionic crystal is one having its ions arranged periodically in three dimensions. According to classical theory, such a structure of polarizable ions should have dielectric or electrical insulating properties independent of frequency, with very low losses, at radiofrequencies.

However, a real crystal exhibits many departures from this ideal lattice arrangement. These defects are either in the form of ions out of place, with accompanying vacant sites (Frenkel defects), as in silver chloride, or in the form of equal numbers of vacant positive and negative ion sites (Schottky defects), as in the alkali halides.

The DC conductivity of simple ionic crystals has been studied extensively. However, as the experiments described in this paper show, AC excitation produces an unexpected effect, attributed to a jumping of the positive ions to vacant sites under the influence of the applied field. The jumping is observed as a relaxation process, producing a very small change in the dielectric constant and an associated peak in the dielectric loss which is readily measurable. Using silver chloride and alkali halides that were heat-treated to introduce a relatively large number of lattice defects, the dielectric loss and constant were measured first over a range of frequencies at fixed temperature and then over a range of temperatures at fixed frequency. From resulting data it was possible to calculate the number of moving defects in the sample, the activation energy for diffusion of the positive ion in the crystal, and ultimately the activation energy for defect formation. These values are of considerable importance in studying the nature of the defects, as well as the process of diffusion which takes place by means of the defects and also color centers arising from the trapping of an electron at a vacant negative ion site. R.G.B.

Low Frequency Dispersion in Ionic Crystals. By R. G. Breckenridge. *J. Chem. Phys.* 16: 959, October 1948.

Light Helium

The natural occurrence of a helium isotope of atomic weight 3 was observed in the Berkeley cyclotron in 1939 by Alvarez and Cornog, who showed that its abundance was very low compared with that of the normal helium atom of atomic weight 4. It was shown in 1946 at the University of Minnesota that the isotope was not nearly as rare as first reported, so that its abundance could be measured conveniently with a mass spectrometer.

A high resolution, high sensitivity mass spectrometer made possible studies leading to the separation or enrichment of the isotope, opening up two new fields of research. First, He^3 is the third lightest and thus one of the very simplest nuclei occurring in nature. Hence its existence in separated quantities will make possible studies of its nuclear properties so that more will be learned about the interaction between protons and neutrons and other light particles. Second, it has been shown that He^3 has markedly different properties from He^4 at liquid helium temperatures. Its availability enlarges the scope of low temperature investigations.

Thermal diffusion is particularly effective in separating molecules that have a large percentage difference in mass and that act like hard spheres in collisions. For this reason it appears to be a method peculiarly adapted to the enrichment of He^3 in helium. Accordingly, a small