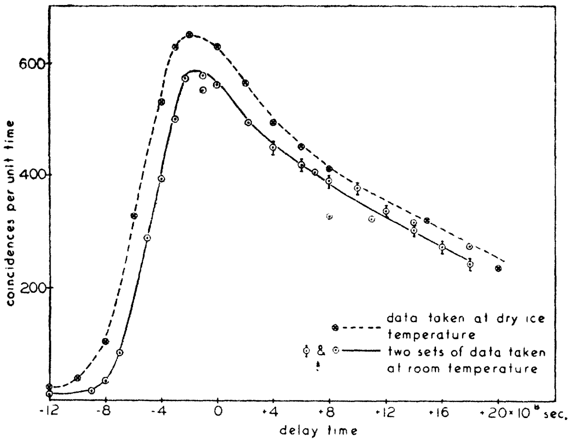

FIG. 2. Comparison of coincidence rate *versus* delay curve for calcium fluoride scintillations taken at room temperature and at dry ice temperature. Note similar decay rates within the accuracy range of the equipment.

magnitude to be detected by this equipment. Plotting of this decay section of the curve shows the half-life to be still in the range of $14\text{–}16\times10^{-8}$ second.

The apparent temperature independence together with the magnitude of the decay time indicate several possibilities: (a) the process of emission may be a straight radiative transition of a slightly forbidden state; (b) if the process is one of electron migration the barrier would be small, say of the order of a few hundredths of an electron volt with the tunnel effect being large in relation to overcoming the barrier; (c) the process may be twofold, with fast electron migration preceding radiative transition.

The writer wishes to express his thanks to Professor E. C. Pollard for valuable discussions throughout, to Professor H. L. Schultz for discussion of coincidence counting techniques and circuits involved, and to Dr. R. B. Setlow for suggestions on interpretation. Thanks are also due Mr. J. A. Rich for loan of the naphthalene and calcium fluoride crystals.

* Assisted by the joint program of the ONR and the AEC.
[1] Conference on Scintillation Counters and Crystal Counters, University of Rochester, Rochester, New York, July 1948.
[2] H. L. Schultz, *High Speed Counters and Short Pulse Techniques* (Brookhaven Conference Report, August 1947), p. 35.
[3] F. W. Van Name, Phys. Rev. **75**, 102 (1949).

Anomalous Behavior of the Dielectric Constant of a Ferromagnetic Ferrite at the Magnetic Curie Point

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IN the discussion following our papers "Magnetic Properties of a Ferromagnetic Ferrite," presented at the 1948 Annual Meeting of the American Physical Society, we showed the lantern slide reproduced here. This represents the effective dielectric constant, as a function of temperature, measured at 10,000 c.p.s. on a block of a commercial ferromagnetic ferrite (Ferroxcube III) provided with evaporated gold electrodes. Direct current measurements of the resistivity of the block were made at the same time and show, in the same temperature interval, only the variation with temperature expected of semiconductors.

At that time we thought that the almost discontinuous course of the dielectric constant *versus* temperature curve at the magnetic Curie point might be some indication of the

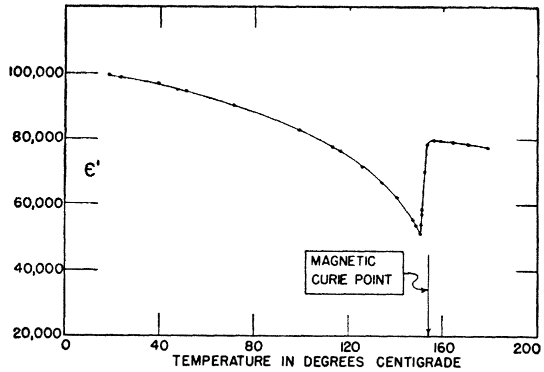

FIG. 1. Real part of dielectric constant *vs.* temperature.

fundamental character of the dielectric behavior, perhaps related to a coupling of the electric and magnetic dipoles.

We have found, however, that the behavior of the dielectric constant at the magnetic Curie point can be described on the basis of straightforward electromagnetic theory. The decrease in the measured dielectric constant between room temperature and the Curie point is due principally to the increasing ohmic conductivity in this region. The sudden rise at the Curie point follows from the collapse of the permeability. Differences between the experimental and calculated curves indicate that the actual dielectric constant decreases slowly with increasing temperature throughout the entire region.

A paper covering in more detail our work on the dielectric and magnetic properties of a ferromagnetic ferrite is in preparation for submission to the Physical Review.

Divergences in Field Theory

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THE considerable advances which have recently been achieved in quantum electrodynamics have been based on the twin concepts of charge and mass renormalization. Thus it has been found that the divergences that occur as a result of the interaction between electron and electromagnetic fields are due to terms which, if finite, would be interpreted as changing the mechanical mass and charge of the electron to the empirically observed values. On separating out the additional mass and charge terms, it has been found that the present form of electrodynamics gives finite and unambiguous predictions with at least reasonably close agreement with experiment.

The question immediately arises as to whether the use of these concepts is sufficient to remove the divergences of other current or proposed forms of quantum field theories, or if their success is an accident peculiar to electrodynamics. Offhand, one would say that the latter is obviously the answer. The divergences encountered with a Dirac electron interacting with the electromagnetic field are particularly weak. While it would seem not unreasonable that the removal of two infinite quantities would render electrodynamics convergent, the success of this procedure in theories with much stronger divergences is *a priori* rather unlikely. Surprisingly, it has been found that the utilization of the renormalization ideas does give convergent results for the scalar and pseudoscalar meson theories (even with dipole coupling) and for the scalar electron interacting with the electromagnetic field. This might tend to support the view that all the divergences of the