

III. SOLID STATE PHYSICS

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A. THE THEORY OF SUPERCONDUCTIVITY

The well known phenomenological theory of F. and H. London leads to rather severe restrictions for the electronic wave functions which might possibly account for the phenomenon of superconductivity. Yet all attempts to construct such wave functions according to the principle of quantum mechanics have been so far unsuccessful. This failure seems to stem from the use of one-electron functions for a problem for which the electronic interaction is of great importance. It was generally assumed that the many electron wave functions are too difficult to handle.

Actually, the Bloch-Slater theory of ferromagnetism required the use of many electron functions, but these were not associated with any current and thus were not appropriate for a theory of either normal- or super-conductivity.

We have introduced a new type of many-electron function which contains the previously used wave functions as special cases but includes situations which eluded the earlier theories. The general nature of these wave functions precludes a too specific calculation. The discussion has been confined rather to an investigation of the properties of the functions with respect to the group of crystal translations. The current-carrying properties of the corresponding electronic states essentially follow from these translational symmetry properties.

The formalism provides the possibility of states which, according to preliminary investigations, appear to have the electric, magnetic and thermal properties of superconductors. The work is being continued.

L. Tisza

B. SOFT X-RAY VACUUM SPECTROGRAPH

The pumping systems for the vacuum spectrograph and x-ray enclosures are under test. The spectrograph chamber is fitted with a six-inch-diameter metal, oil diffusion pump, and the x-ray tube with a similar three-inch pump. Both diffusion pumps are backed by glass single-stage oil booster pumps.

The slit system, the diffraction grating holder, and other mechanical parts of the optical system have been fabricated and are in the process of assembly. The grating has a two-meter radius and is ruled on glass with

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30,000 lines per inch. It was ruled by R. W. Wood and is the same one used by O'Bryan and Skinner in their soft x-ray work at M.I.T. some years ago.

It is planned to use as the detecting element a beryllium-copper eleven-stage electron multiplier that will travel along the Rowland circle, preserving its orientation with respect to the tangent. The driving mechanism for this motion has been completed, but has not yet been tested for reproducibility of setting. Other components, such as amplifiers and power supplies, have been constructed. Provision has also been made for photographic recording.

An electron gun with the desired spot size, and current and voltage characteristics, is still in the experimental stage.

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