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INTERNATIONAL CONFERENCE ON THE SCIENCE OF SUPERCONDUCTIVITY

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This issue contains the Proceedings of the International Conference on the Science of Superconductivity held at Colgate University, Hamilton, New York, 26-29 August 1963. Sponsors of the Conference are the International Union of Pure and Applied Physics, the Advanced Research Projects Agency, the National Science Foundation, and the General Electric Research Laboratory.

The idea of holding the conference began with a suggestion by G. W. Rathenau, Secretary of the Solid State Commission of the International Union of Pure and Applied Physics. It was felt that because of the rapid growth of the field, it would be an opportune time to review the fundamental problems of superconductivity, and to discuss current research. General policies were formulated by a Conference Committee consisting of John Bardeen, Chairman, University of Illinois; W. M. Fairbank, Stanford University; M. D. Fiske, G. E. Research Laboratory; C. J. Gorter, University of Leiden; J. K. Hulm, Westinghouse Research Laboratory; J. E. Kunzler, Bell Telephone Laboratories; P. M. Marcus, IBM Research Laboratory; B. T. Matthias, University of California, La Jolla; K. Mendelssohn, Oxford University; A. B. Pippard, Cambridge University; R. W. Schmitt, Secretary, G. E. Research Laboratory; M. Tinkham, University of California, Berkeley; Howard Etzel, NSF Representative; and Charles F. Yost, ARPA Representative.

This Conference follows at approximately two-year intervals after similar conferences held at Cambridge University (1959) and at the Thomas J. Watson Research Laboratory of the International Business Machines Corporation (1961). It is not intended in any way, however, to set a pattern or precedent for future conferences. It is believed by the organizers that topical conferences such as this one should be held only when warranted by current scientific interest.

The very rapid growth of interest in superconductivity in recent years is well illustrated by the increase in numbers of participants and papers presented at these three conferences. The Cambridge Conference had about 90 participants, the IBM Conference about twice this number, and attendance at the present Conference was about 350, roughly a two-year doubling time. There were corresponding increases in the number of papers submitted.

Highlights of the Cambridge Conference were experiments and theory to test various aspects of the microscopic theory, while those of the IBM Conference were flux quantization, tunneling into superconductors, and superconducting materials which withstand very high magnetic fields. Probably those of the present Conference are further experiments on flux quanta and quantized flux lines, unraveling of the structure of type II superconductors, and experiments and theory relating to

Josephson's remarkable prediction of supercurrent flow across a tunneling barrier. An interesting informal discussion of Josephson tunneling, not reported in these proceedings, was held on the afternoon of 28 August. Much interesting experimental work was reported on the occurrence of superconductivity in alloys and compounds of transition metals; the theory is as yet in its primitive stages.

The program consisted of invited talks of a semi-review nature as well as submitted contributions based on current research. The number of contributed papers exceeded by far the expectations of the Conference Committee. Although the final program was a very crowded one, extending over four days, it was possible to accept only about 60% of the papers submitted for presentation. The difficult task of selecting these papers was performed by the Program Committee consisting of M. Tinkham, Chairman, University of California, Berkeley; P. W. Anderson, Bell Telephone Laboratories; C. P. Bean, G. E. Research Laboratory; W. M. Fairbank, Stanford University; J. K. Hulm, Westinghouse Research Laboratory; J. E. Kunzler, Bell Telephone Laboratories; W. A. Little, Stanford University; B. T. Matthias, University of California, La Jolla; F. Reif, University of California, Berkeley; and J. R. Schrieffer, University of Pennsylvania. The papers accepted were chosen not only for scientific merit, but also to give a balanced program representing various approaches being taken to the fundamental problems of superconductivity. Unfortunately, many contributions equally as interesting as those selected had to be omitted. It is hoped that those chosen will give a good picture of the present status of current research.

Discussions following the formal presentations were recorded and then typed by the secretarial staff. The remarks were edited by D. H. Douglass, University of Chicago, before they were sent to the contributors for final revisions.

Special features of the Conference were talks given at dinner on two of the evenings by C. J. Gorter and K. Mendelssohn on their recollections of research on superconductivity in the 1930's, another very active and productive period. Their talks are reproduced in these Proceedings.

A notable omission is the lack of participation of scientists from the U.S.S.R., where much important work in superconductivity is being done. Invitations were sent to a number of leading Soviet scientists, but unfortunately they were not able to come. Even though they were not present in person, their work

was discussed frequently. It should be noted that our theoretical understanding of type II superconductors is due mainly to Landau, Ginsberg, Abrikosov, and Gor'kov, and that the first definitive experiments were carried out as early as 1937 by Shubnikov.

There has been some confusion regarding nomenclature for the upper and lower critical fields of type II superconductors, dating back to some of the Russian literature. It was believed desirable by many attending the conference to attempt to standardize the notation. On recommendation of the Conference Committee, the following resolution was introduced by Professor C. J. Gorter, and passed by a nearly unanimous vote of the conferrees:

Resolved:

That this body transmit to the appropriate international commission the following:

We, conferees at the International Conference on the Science of Superconductivity, Hamilton, New York, U.S.A., advise the use of the symbols H_{c1} and H_{c2} to express the limits of the mixed state in Type II superconductors. H_{c2} is taken to be the upper field limit while H_{c1} is reserved for the lower field limit.

This notation (in the Russian version, H_{k1} and H_{k2}) is that introduced by Shubnikov in 1937, who was the first to give names to the critical fields. Copies of the resolution have been sent to Professor Fleury, Secretary General of IUPAP, Professor Rathenau as Secretary of the Solid State Commission, and to Professor Shoenberg of the Low Temperature Commission. The notation has been adopted in these Proceedings, and it is hoped that its use will become universal.

Much credit for the success of the Conference is due to a very able Conference Staff provided by the General Electric Research Laboratory consisting of W. J. Geroulo, supervising; J. Reardon, finance; A. C. Perreault and S. A. Hanna, audiovisual equipment and arrangements; and Mary Beldon, Nancy Crawford, and Viola Rupp, secretarial. Excellent living arrangements as well as meeting and recreation rooms were provided by Colgate University. Mr. John Littlefield, Treasurer of the University, and his staff were outstandingly cooperative and helpful.

JOHN BARDEEN, University of Illinois
Conference Chairman

ROLAND W. SCHMITT, General Electric
Research Laboratory
Conference Secretary