COMMEMORATION OF JOHN HUBBARD (1931-1980)

BY
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The world of physics has suffered a great loss with the recent untimely death of John Hubbard. This is particularly true of those of us in the field of condensed matter physics and especially those who are concerned with the topics of localization and disorder that are the subject of this conference. It is very appropriate that at this conference we commemorate John Hubbard's passing by recalling some of his numerous important contributions to condensed matter physics and to the problems under discussion here.

When John Hubbard started his career in theoretical physics it was known that a surprisingly good understanding of the electron gas in metals could be obtained by ignoring the Coulomb interaction among the electrons but there was no understanding of how to develop a consistent way to treat these interactions. John Hubbard's doctoral thesis developed the dielectric approach to the problem and it was soon followed by a series of papers which are at the heart of the modern many body theory of the electron gas. J.R. Schrieffer has said of these papers, which had wide impact on the physics of metals, "His early work on the theory of exchange and correlation in the electron gas remains a classic".

Shortly thereafter, John Hubbard turned his attention to a different way of treating the many body problem. The result was a short but very influential paper which developed the method of functional integration. Over the years since his original contribution, many others have applied this method to a variety of problems, especially to the problems of electron localization. Indeed in his last major contribution John Hubbard came back to this method and applied it to the development of a first principles theory of the magnetism of iron and other transition metals. This work resolved the difficult theoretical problem of reconciling the simultaneous localized and itinerant behaviour of the magnetic electrons in 3d-metals and yielded a single model which gives reasonable values of both the magnetic moment and Curie temperature.

John Hubbard however is best known for the classic series of pa-

pers that treated electron correlations in narrow band materials. While the importance of correlation in causing the breakdown of band theory and insulating character of magnetic insulators was known from the work of Mott, Peierls, Van Vleck and Anderson, it was John Hubbard who put the problem on a firm foundation. The famous Hubbard Hamiltonian for electron correlation is as crucial and fundamental as the Ising and Heisenberg Hamiltonian for localized spins and by now has spawned almost as much work. However the large literature on the Hubbard Hamiltonian that now exists also serves to emphasize the importance of his original contribution and the depth of his understanding. W.Kohn has described his contribution as "the basis of much of our present thinking about the electronic structure of large classes of metals and insulators". It is also the basis of much of what we are discussing at this conference.

John Hubbard studied at Imperial College, University of London, receiving B.Sc. and Ph.D. degrees in 1955 and 1958 respectively. Most of his scientific career was spent as Head of the Solid State Theory Group at the Atomic Energy Research Establishment in Harwell, England. He visited a number of institutions in the U.S. at various times in his career and in 1976 he joined the staff of the IBM Research Laboratory at San Jose, Ca., a position he held at his death.

John Hubbard's work was characterized by great originality and by an uncommon ability to obtain elegant mathematical formulations and solutions of very difficult and fundamental problems. His passing leaves a void in the theoretical physics community which will not be filled.