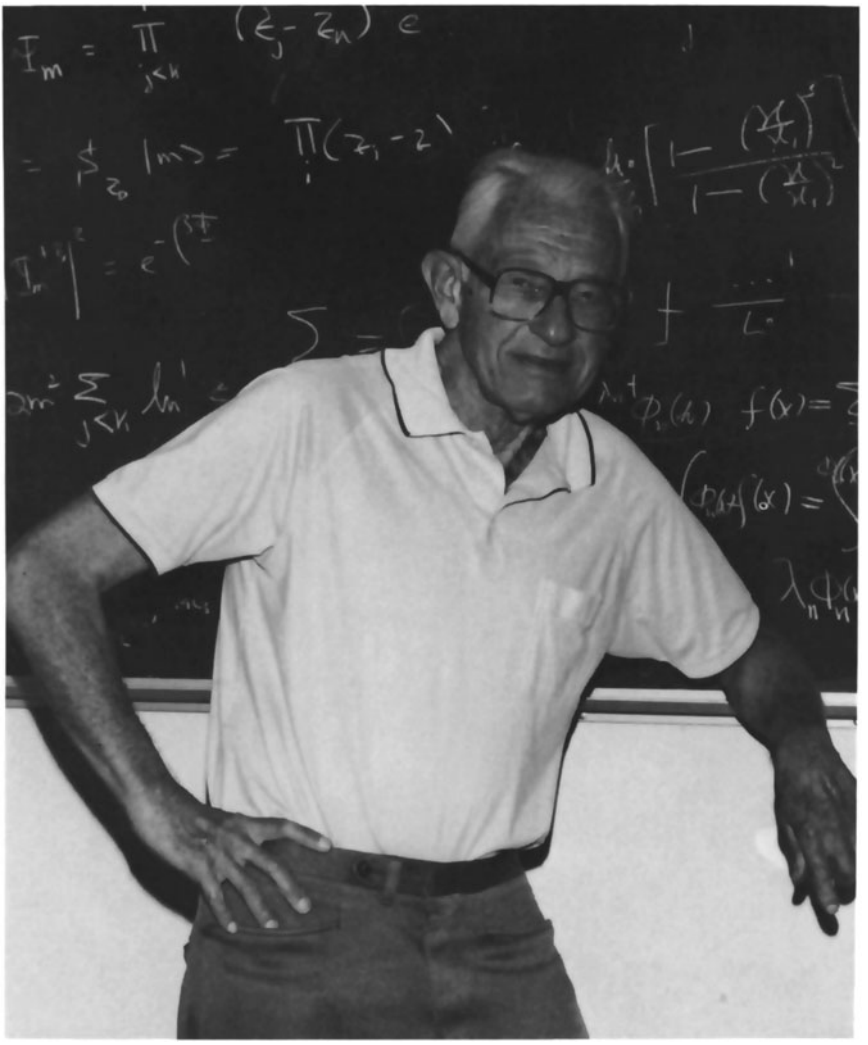
Condensed Matter Physics
The Theodore D. Holstein Symposium



Theodore D. Holstein

Raymond L. Orbach, Editor

Condensed Matter Physics

The Theodore D. Holstein Symposium

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Preface

Theodore David Holstein died May 8, 1985, at the age of 69. His research career covered 46 years. His contributions have been seminal throughout this period, beginning with his first papers with H. Primakoff in 1939 and extending to the year of his death.

"Ted" earned his Ph.D. in physics from New York University in 1940, after earning his Master's degree from Columbia University in 1936 and his B.S. from N.Y.U. in 1935. After receiving recognition while he was a graduate student for his contributions to the atomic theory of magnetism, he participated in the development of radar at the Westinghouse Research Laboratories, where he was a research physicist from 1941 to 1959. He taught on the faculty of the University of Pittsburgh from 1959 to 1965. He joined the Physics Department of the University of California, Los Angeles, where he remained until his death. Ted is survived by his wife Beverlee, his daughter Lonna Smith, his son Stuart, and his grandson Andy Smith.

Ted received many prestigious awards and honors, including membership in the National Academy of Sciences and the American Academy of Arts and Sciences. He received a von Humboldt fellowship for research at the University of Regensburg in the Federal Republic of Germany.

The Theodore D. Holstein Symposium was held in Ted's memory on the campus of the University of California, Los Angeles, and at its Conference Center in Malibu, March 28–29, 1986. There were 73 attendees, spanning the research community from graduate students to Nobel Laureates. All were invited to contribute either original research articles or memorabilia to this volume. We are grateful to all those who have contributed to the Symposium, especially the financial support of the Westinghouse Research Laboratories and the University of California, Los Angeles.

Those of us who had the privilege of working with him know that we were all Ted's "students." We feel a profound emptiness which will not be filled. But Ted's legacy of integrity and dedication will long remain. His scientific papers are classics: incisive, complete, and richly detailed. Many of them laid the foundation for all future work in their area and related areas. A glance at

his bibliography makes clear the contributions he has made to physics, and the reason so many of us are indebted to his scientific leadership.

Ted's thesis work with H. Primakoff in 1940 gave birth to the Holstein–Primakoff transformation which still forms the basis for treatments of spin-waves in ordered magnetic materials. His work on the imprisonment of resonant radiation in the late 1940s established a new field and is a model of clear, insightful analysis. It has been found useful not only for gases, but also for the solid state; not only for photons, but also for phonons. Ted's short article on the optical and infrared volume absorptivity of metals in the early 1950s has since been found to be fundamental for the analysis of the infrared absorption of normal metals and superconductors. Typically, the full work can be found in a Westinghouse unpublished report. Nevertheless, his short published article has had great impact.

This work was followed by half a decade of silence, to be broken by a veritable torrent of profound contributions. His calculation of the collision-drag effect laid the microscopic foundation for the beautiful macroscopic treatment of Pippard. His powerful and singularly successful series of papers on the polaron appeared the same year. Everyone who works on the polaron problem must make reference to these seminal papers. Again, at nearly the same time, he began a series of papers connected with the motion of a Bloch electron in a magnetic field. This led to the analysis of the Hall effect for impurity (hopping) conduction; high-frequency cyclotron resonance in an electron-phonon gas (with H. Scher); Hall mobility of the small polaron (with Lionel Friedman); the side-jump mechanism for the ferromagnetic Hall effect (with S.K. Lyo); the adiabatic theory of the Hall effect (with David Emin); the ferromagnetic Hall effect in the electron-phonon gas (with S.K. Lyo); and the ac ferromagnetic Hall effect (with S.K. Lyo). Taken together, these papers have had an impact on the entirety of the condensed matter field.

One of Ted's most elegant works is his study of the transport properties of the electron-phonon gas, some 149 pages in length, which appeared in the *Annals of Physics* in 1964. This monumental work, and especially its appendices, laid the foundation for the Boltzmann equation. It is a remarkably clear and complete work, and is a very effective textbook in its own right. It clearly displays his complete mastery of diagrammatics, and more important, his physical understanding.

In the mid-1970s, Ted clarified the microscopic basis of the Forster–Dexter theory of excitation transport in a series of papers (with S.K. Lyo and R. Orbach). This work forms the basis for the analysis of fluorescent line narrowing spectroscopy. His interest in spectroscopy led to the first successful microscopic theory for cooperative optical absorption (with S. Alexander and R. Orbach).

In the late 1970s, Ted began an extraordinary series of papers using a "simple" model to provide a quantitative and full expression for a chemical-rate theory of polaronic hopping. He then began a monumental series of papers exploring higher-order effects in hopping-type transitions of small polarons. This led to work completed just before his death on the motion of solitons in a dynamic

lattice (with B. Schutler). He approached the problem of phonon–soliton interaction in the same fashion which marked so much of his work. He introduced a "simple" model which exhibited all of the important physics and then proceeded to analyze it in extraordinary depth. The full physical content of the problem emerged quantitatively.

This listing does not do justice to Ted's contribution to science. One must understand that the papers themselves are models of clarity. They bring order to subjects which previously had not been clear as to their microscopic basis. His work provided an inspiration to his generation, and to its students. It will remain a living monument; subsequent generations of scientists will turn to it for understanding and inspiration.

Ted's memory will inspire us all. He was one of the leading theoretical physicists of his generation. He was the quintessential physicist, who did not tolerate sloppy thought in anyone's work, especially his own. Ted was uncompromising in his search for understanding in physics.

It is for all these reasons that this symposium was organized. Those of us who were privileged to know and work with Ted hope that our contributions will acquaint others with his insight and accomplishments.

This volume is dedicated to his memory. We all miss him greatly.

Raymond L. Orbach
April, 1987

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