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Charles Kittel

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Charles Kittel

Solid-state physicist Charles Kittel, a professor emeritus at the University of California, Berkeley, passed away peacefully at his home in Berkeley on 15 May 2019, two months before his 103rd birthday.

Born in New York City on 18 July 1916, Charlie entered MIT in 1934. He moved to Cambridge University in 1936 and received his BA there two years later. He earned his PhD degree in 1941 from the University of Wisconsin–Madison, where his adviser was Gregory Breit. From 1940 to 1942, Charlie did research on problems in degaussing and magnetic mine warfare at the Naval Ordnance Laboratory. He served in the US Navy as a research physicist at a British Admiralty research establishment in Scotland and as a naval attaché at the US Embassy in London; he went on to work on antisubmarine warfare and operations research in Washington, DC, and London. In 1945 he returned to MIT as a researcher at the Research Laboratory of Electronics.

Charlie was a research physicist in the solid-state physics group at Bell Labs in Murray Hill, New Jersey, from 1947 to 1951. His work ranged over much of solid-state theory, including magnetism, ultrasonics, and thermal properties. His association with the physics department at Berkeley began in 1950 with a visiting associate professorship. He joined the faculty as professor of physics the next year and became emeritus in 1978.

Among Charlie’s many honors were the American Physical Society’s Oliver E. Buckley Condensed Matter Physics Prize in 1957, the University of California Distinguished Teaching Award in 1970, and the Oersted Medal from the American Association of Physics Teachers in 1978.

Charlie is credited with building the solid-state (now condensed-matter) physics component of Berkeley’s physics department. He played a central role in hiring new faculty, and he worked closely with experimentalists who conducted groundbreaking research on cyclotron resonance in semiconductors. Charlie assembled an outstanding theoretical group of faculty, postdoctoral researchers, and graduate students, and he established and developed undergraduate and graduate courses in condensed-matter, thermal, and introductory physics. His texts in those areas are classics. In particular, his *Introduction to Solid State Physics*, originally published in 1953, was not only the dominant text for teaching in the field, it was on the bookshelf of researchers in academia and industry throughout the world. In many ways, his choice of content defined solid-state physics.

For much of his career, Charlie focused his research on topics related to determining material properties. They included semiconductors, magnetic behavior, ferroelectrics, optical properties, electron spin and nuclear magnetic resonance, and superconductivity. In 1946 he showed that technologically important fine-particle ferromagnets had high coercivity because the particles remained single domain when fine enough. In 1946 James Griffiths found that the ferromagnetic resonance frequency in thin films is proportional to the square root of the product of magnetic induction, B, and the strength of the external field, H, instead of to H alone, as is the case in nuclear and paramagnetic resonance. Three months after Griffiths’s paper appeared, Charlie published his proof that the dependence arose from the demagnetizing field. That and Charlie's related early work substantially strengthened our theoretical understanding of ferro- and ferrimagnetism. He pointed out that glasses had low thermal conductivity because their structural disorder reduced the phonon mean free path to the atomic scale, an early recognition of the importance of strong disorder for transport.

In a classic paper on cyclotron resonance in p-type germanium, Charlie, Gene Dresselhaus, and Arthur Kip reported the first direct measurement of the kinematics of electrons in solids. They confirmed in quantitative detail the correctness of band theory and demonstrated the importance of including spin–orbit coupling. In private communication to one of us (Morrel), Enrico Fermi recognized the significance of their findings.

With Malvin Ruderman, Charlie initiated the development of what today is known as the RKKY interaction, now understood to be responsible for giant magnetoresistance in layered materials. With Kip, Paul Levy, and Alan Portis, Charlie carried out one of the earliest studies of electron-spin resonance in color centers. Such centers are now of interest for quantum computing.

In addition to his family, Charlie will be remembered by the colleagues with whom he worked and by the students and postdocs whom he mentored, including Nobel laureate Pierre-Gilles de Gennes. Members of the physics community and readers of his texts will remember Charlie for his amazing ability to look at complex properties of matter and come up with simple models and accurate descriptions that defined the essence of the physics.

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