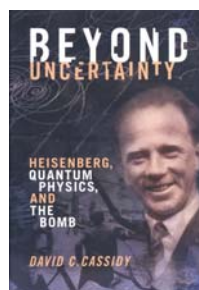


conducted research in non-linear field theory.

The attempted post-World War I Communist revolution in Munich during the last years of Heisenberg's gymnasium (high-school) studies seems to have been, according to the book, a defining event in his life. As part of a militaristic, nationalistic student body at his elite high school, young Heisenberg participated in the right-wing counter-revolution, during which he met men from the German working class—at the opposite end of his gun. It was during that time that he also became a leader of a German equivalent of the Boy Scouts, but theirs was too nationalistic to be an affiliate of the actual internationally oriented organization. Heisenberg maintained his preoccupation with young people for most of his life.

The book describes Heisenberg's collaborations as a student and researcher with Arnold Sommerfeld in Munich, Max Born in Göttingen, and Niels Bohr in Copenhagen; Heisenberg also collaborated and sometimes competed with Erwin Schrödinger and most of the other great physicists of the 1920s and 1930s. In Cassidy's book, we follow Heisenberg's development of matrix mechanics, the uncertainty principle, the formalism of quantum mechanics, and the Copenhagen interpretation. We learn about his struggles with the increasing politicization of the German universities and his receipt of the 1932 Nobel Prize in Physics. His long-term goal was to succeed Sommerfeld as physics chair at the University of Munich, but he never achieved it, because the local Nazi party was dissatisfied with his political "purity."

The physics content in the book is qualitatively sketched—there are no formulas or experimental descriptions. The intended audience is not "scientists as scientists," but rather, the general public. At the onset of World War II, Heisenberg was ensconced as the youngest professor of physics at the University of Leipzig, where he built a formidable theory group in spite of the Nazi distaste for theoretical physics, which they referred to as "Jewish science." Except for his responses to direct attacks on his person or his science, Heisenberg spent those years immersed in closed but international scientific circles, and in his music (he was an excellent pianist who gave many private recitals), his youth group, and its hiking activities. He was also very attentive to the six children he had from his mar-



riage to a much younger wife.

Considerable controversy centers on the extent of Heisenberg's involvement with the Nazis during the war. Did he help them build nuclear weapons? Did he try to save fellow scholars from Nazi persecutions or the military draft? And why did he visit his old teacher and friend Bohr in Nazi-occupied Copenhagen? Was it to spy on the nuclear weapons activities of the Allies, to boast about Germany's nuclear activities, or to initiate some sort of nuclear truce with the Allies that would include the mutual cessation of nuclear weapons research? Cassidy does a commendable job of presenting the evidence for all sides of each controversy and the evident weaknesses of the various arguments—he includes 45 pages of notes! He reminds readers of the passage of time and memory and the paucity of written documentation, and allows them to reach their own conclusions.

The controversy did not end with World War II, which resulted in the complete devastation of Heisenberg's beloved Germany. His self-appointed task, at which he was largely successful, was to be a major factor in the rebuilding of German science to its pre-war eminence. In that task he could not afford to be tainted with the suspicion of wartime moral or professional lapses. Hence, colleagues and friends such as Carl Friedrich von Weizsäcker circulated the word that Germany's failure to create a nuclear weapon during the war was due to the ethical reluctance of German physicists to provide Hitler with such weapons, rather than to any scientific or organizational failures on their part. Again, the author presents the available evidence, including the famous Farm Hall tapes (see Cassidy's article with Jeremy Bernstein in *PHYSICS TODAY*, August 1995, page 32), secretly recorded British intelligence tapes of technical and personal conversations among the German physics elite as they were comfortably captive in an English estate. The tapes document the German physicists' surprise at the success of the Allied nuclear weapons program—the Manhattan Project—when it was made public by the destruction of the Japanese cities of Hiroshima and Nagasaki. Once again, the author lets readers make up their own minds. After reading the facts, I was left in profound disbelief of von Weizsäcker's "ethical reluctance" story.

Beyond Uncertainty is interesting, well written, and amply documented. I

urge *PHYSICS TODAY* readers to read it and make up their own minds about the many questions raised in this excellent discussion of science, society, and the influence of the individual scientist.

Alvin M. Saperstein
Wayne State University
Detroit, Michigan

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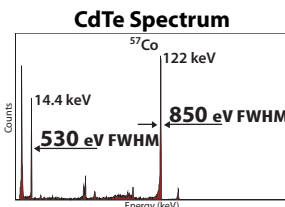
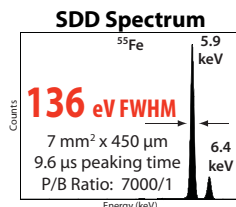
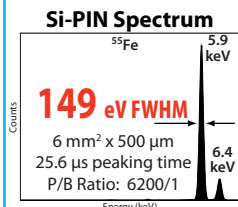
Cosmic Collisions: The Hubble Atlas of Merging Galaxies. L. L. Christensen, R. Y. Shida, D. De Martin. Springer, New York, 2009. \$39.95 (139 pp.). ISBN 978-0-387-93853-0

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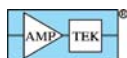
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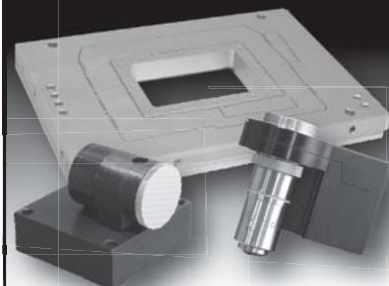
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