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Book review

Einstein's Generation: The Origins of the Relativity Revolution, Staley Richard. University of Chicago Press, Chicago (2009), pp. x+494. US$ 38.00 PB, ISBN: 978-0-226-77057-4

The title *Einstein's Generation* immediately suggests names such as Ehrenfest, Ritz, Kaufmann, Born, Laue, and Laub. Staley's book discusses these individuals, but it actually has a broader scope. Both the title and the subtitle are not quite appropriate. A much more fitting title would be *Michelson, Electrons, and the Rise of "Modern" Physics*. The emphasis on Albert Michelson is evident in the Index: almost four columns on him, compared to just one and a half on Einstein. Likewise, "Einstein's generation" includes, for Staley, many other physicists who were quite older than Einstein, such as Lorentz, Planck, Poincaré, and Minkowski. The book exhibits a composite character because it includes and expands upon four articles that Staley had published earlier on Michelson, relativity, and the co-creation of modern and classical physics. Hence the book is partly a bridging work; it ambitiously connects areas in the history of physics, from the 1880s until 1911. Staley identifies how diverse interests produced cross-fertilization, and how various disciplinary boundaries were crossed. He wants to discuss material culture, experiment, and theory, all on the same footing. Every page of the introduction seems to quadruple the scope; he writes about individuals and communities, consolidation and diversification, power and weakness, memory and neglect, the cultural and the material, the classical and the modern, and the absolute and the relative.

Staley's chapters on Michelson constitute the best account of Michelson's works that I have read; treating both the intricacies of experiments and Michelson's relationships to other scientists. Staley aptly describes how Michelson engaged astronomers and instrument makers, while developing his researches on optics. Once Michelson became famous, he abstained from citing the names of the assistants, artisans, and instrument-making firms that assisted him. He gradually departed from the particular, reaching instead for pure science. His instruments became generic, though not quite practical. Michelson complained that his first interferometric experiment on detecting the ether drift received very slight attention. Such indifference seems to have discouraged him from pursuing planned variations, such as carrying it out on a mountaintop. Having failed to move physicists to take an interest on his accurate experiment, Michelson turned to try to generate interest in his innovative instrument, the interferometer. He worked to develop measurement standards, especially using the speed of light to establish a natural standard of length. Whereas Michelson sought numerical values that could serve the scientific community, his techniques and instruments remained largely personal, as hardly any scientists even bothered to replicate his work.

Following his exemplary analysis of the experimental and metrological works of Albert Michelson, Staley discusses international interactions among physicists. During its seven months of duration, the World's Fair of 1900, in Paris, received more than fifty million visitors, including many physicists. At the time, there were roughly 1300 working physicists in the world, and it is striking that reportedly 836 of them attended the International Congress of Physics of 1900, in Paris. More than half of the world's physics community (including eminent leaders such as Poincaré, Lord Kelvin, and the Curies) attended this international congress of unprecedented dimensions at the very start of the twentieth century. Machines, instruments of precision, and scientific breakthroughs were displayed as heralds of modernity. Yet this event seems to have left no trace in the collective memory of physicists; it was forgotten, seemingly inconsequential. By contrast, in 1911, merely eighteen physicists met in Brussels at an exclusive and "private" gathering funded by the Belgian industrialist Ernst Solvay. This latter meeting is prominently remembered by physicists and historians as a landmark event in the formation of modern physics. Staley fairly asks: Why was it that the extraordinary International Congress of Physics of 1900, in Paris, is now largely forgotten, whereas the diminutive Solvay Council of 1911 stands out in the collective memory? The question becomes more puzzling when we recall that Einstein commented that he learned nothing new at that Solvay meeting. Staley tries to answer the question by arguing that the Solvay Council was important because it defined a new construal of the physics *of the past*.

In 1911, the small group of physicists at Brussels congealed a new notion of the "classical" past, allegedly characterized greatly by the physics of the ether. Accordingly, most physicists and most historians associate the expression "modern physics" with the theories developed upon and after the abandonment of the ether. However, Staley explains that this common, major partition of history is artificial, because, to the contrary, in the 1880s Michelson and other physicists characterized physics as "modern" partly inasmuch as it prominently involved the ether. Staley also argues that there are good reasons not to regard Lord Kelvin, for one, as a "classical" physicist, despite his advocacy of mechanical explanations, mainly because he rejected the equipartition theorem, which for decades now has been regarded as part of classical physics.

Staley traces how sketchy, proto-historical accounts by Einstein, Minkowski, Planck, and others influenced physicists' attitudes toward special relativity and the quantum. Staley also traces how Einstein's relativity became incorporated as a secure foundation of modern physics, and how it was gradually refined by various contributors. Einstein and Born puzzled over the apparent impossibility of bringing a resting body into uniform rotation. Born formulated a new definition of rigidity. Staley argues that, to an extent previously neglected by historians, experiments on electrons (especially by Kaufmann) contributed to the development of relativistic physics by Lorentz, Max Abraham, Poincaré, Einstein, and Ehrenfest. Staley provides an outstanding portrayal of Ehrenfest, outside the shadow of his heroes Ritz

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and Einstein, such that Ehrenfest shines as a delightful and independent thinker. Staley argues that the concepts and discovery of electrons helped to define modernity, at least for physicists at the time. Accordingly, it seems quite appropriate to use the electron as a distinctive partition for "modern" physics, even though historians have focused more on quanta and relativity.

Staley is highly concerned with historiography, and hence he highlights many subtle and more substantial departures from past histories. He complains about the abundance of studies on the reception of Einstein's work, and writes as if his own detailed analysis of how Ehrenfest, Born, and others responded to Einstein's work does not itself constitute, again, a reception study (which, anyhow, is nothing to be ashamed of). He insists that instead of writing on the reception of relativity *theory*, he writes about the development of relativity *physics*; but the distinction often vanishes, since, after all, Einstein really did formulate a distinct work, and it was variously received, critiqued, and elaborated. Staley succeeds at elucidating the critical accounts of how physicists struggled to self-consciously articulate and punctuate the recent history of their field. For example, in 1911, Planck advocated the view that 1900 constituted a turning point away from classical physics, which Staley denounces as "a false image of the past." But Staley stops short of providing a clear-cut substitution that punctuates how the history actually developed.

Einstein's Generation abounds with subtle, divergent complexities in the early development of relativity physics; far too many to be fairly characterized in a single book review. By avoiding equations and jargon, the author aims to reach a broad audience, but too many passages presuppose considerable familiarity with the historiography of modern physics, which put the book outside the reach of laypersons and most undergraduate courses. Nevertheless, it should be required reading for graduate students working in the history of modern physics.

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