books

When science and politics collide

Fermilab

Physics, the Frontier, and Megascience

Lillian Hoddeson, Adrienne W. Kolb, and Catherine Westfall
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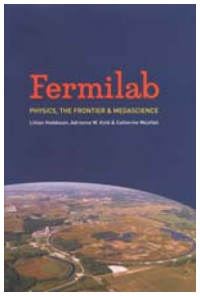
Reviewed by Charles Thorpe

In his classic work *The Politics of Pure Science* (New American Library, 1967), Daniel Greenberg identified President Lyndon Johnson's intervention in the controversy over the site for the next generation of particle accelerators as the start of a "new politics of science." In the new regime, wrote Greenberg, "science was deemed both too important and too expensive to be left exclusively to scientists." It was in that context that in 1967 the National Accelerator Laboratory—renamed Fermilab in 1974—was established.



Fermilab: Physics, the Frontier, and Megascience is an inside perspective on that facility's rich history. Its authors—historians Lillian Hoddeson and Catherine Westfall and Fermilab archivist Adrienne Kolb—do a wonderful job of weaving together the lab's technical and scientific developments with their corresponding social, institutional, political, and economic contexts. *Fermilab* provides details from the 1960s to the end of the 1980s of the often fraught relationships within the physics community and between the physics community and its political paymasters. Central to the book's account of "megascience" is the conflict between the increased scale and cost of experimental physics, particularly the prestigious high-energy physics, and an environment of tightening fiscal constraint. The authors describe how "big science" developed in the wake of the Manhattan Project and in the context of the early cold war when "funding for science in the United States was widely experienced as unlimited." But by the time of Fermilab's establishment, government funding for science "was slowing down." The costs of the Vietnam War combined with the social programs of Johnson's Great Society were straining federal budgets.

In the 1970s the oil-price shock and stagflation decisively marked the end of the postwar boom and led economists and policymakers to question the prevailing economic underpinnings. The boom period for physics was also over, and PhDs faced a worsening job market. Those were difficult times to develop an inherently costly and risky megaproject aimed at "pushing back the frontier" of high-energy physics. Hoddeson, Kolb, and Westfall tell the intriguing story of how Robert Wilson, the former Berkeley Radiation Laboratory student and Los Alamos veteran, arose as the man for the moment. After criticizing the Berkeley Lab's 200-GeV accelerator concept for being overdesigned and hence far too expensive, Wilson sketched out his own radical vision for the technical design, organization, and mission of accelerator physics. He articulated, campaigned for, and embodied a new scientific habitus in which frugality and simplicity were aesthetic and intellectual virtues in addition to being social and economic ones.

Hoddeson, Kolb, and Westfall argue that Wilson drew on the imagery of the frontier not only to signify the ambitions for new knowledge about the natural world but also to legitimize an ethic of frugality and a willingness to make the best of spartan conditions. The book suggests that the ethic of frugality shaped Fermilab's technical design in the concept of an expandable accelerator and in the use of superconductivity in the "energy doubler." Wilson's experimental aesthetic in some ways harked back to the prewar days of "small science" in which the individual researcher was still at the center. In other ways, his emphasis on "flexibility" and "efficiency, savings, and speed" and his attempts to eliminate hierarchy and minimize bureaucracy seem to me to have anticipated new developments in lean and flexible production methods. A source of persistent tension, and indeed pathos, was that pushing the frontiers of particle physics always meant conducting large-scale, collaborative, highly technological, and capital-intensive research. Those aspects of particle-physics research gave rise to organizational structures that clashed with Wilson's more free-wheeling ideal. And the authors acknowledge that experimenters may have been held back by equipment shortages that resulted from Wilson's virtue of frugality.

The last years of Wilson's tenure coincided with the breaking up of the Atomic Energy Commission and its replacement with the Department of Energy. The book gives a strong sense of the "new politics of science" that developed in the 1970s and 1980s. That marked the end of the period in which the elite of the Manhattan Project had dominated American science policy, assured of seemingly unlimited funding by a nation enamored with scientific modernism, and driven by intense techno-political competition with the Soviet Union. The increasingly costly and organizationally unwieldy world of megascience would now be operating in a political and economic world of "total quality management" and "customer orientation."

The book's highly detailed, nuanced, and well-supported account of the intertwined developments in organization, technology, and scientific discovery as Fermilab came to maturity will be essential reading in the history of particle physics and the broader history of 20th-century physics. It will also provide a vital contribution to understanding the interactions of physics with science policy during that period.

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