Book Reviews

A Past Embattlement

Elites in Conflict. The Antebellum Clash over the Dudley Observatory. MARY ANN JAMES. Rutgers University Press, New Brunswick, NJ, 1987. xviii, 301 pp. + plates. $30.

One of the bitterest and noisiest controversies in the annals of American science erupted in Albany, New York, during the 1850s. The inner circle of national scientific leaders whimsically self-styled the "Lazzaroni" squandered time, thought, and energy on it for many months. The affair bemused and divided the larger scientific community. It drew in the business and social elite of Albany, prominent New York State politicians, and members of the U.S. cabinet and Senate. It occasioned numerous editorials, pamphlets, and public meetings. Yet neither scientific fact nor scientific theory were at issue, only a falling out over fiscal and administrative policy between the trustees and the director of the newly founded and still unfinished Dudley Observatory. Historians of American science have been both intrigued and daunted by the sheer volume of polemics, the sheaves of manuscript correspondence, the Byzantine maneuverings, and the fury engendered by what might seem a petty disagreement. Now, at last, with admirable doggedness and common sense, Mary Ann James has laid the mystery open and exposed its larger significance.

The fulminate in the explosion was, to be sure, a compound of pride and personality quirks. The Dudley's director, Benjamin A. Gould, was a driven perfectionist, arrogant, tactless, highly competitive, yet afflicted with spells of self-doubt and depression. James's psychoanalytical post-mortem persuasively suggests in him a "bipolar affective" (or in more familiar terms, manic-depressive) disorder, yet wisely (since a crypt is not a couch) without asserting probability as fact. The trustees' personal and local pride and their strong commitment to fiduciary responsibility could not brook Gould's incorrigible delays, costly refittings, and disdain to explain himself, especially as the Panic of 1857 made continued philanthropic support for the unfinished observatory more desperately necessary and harder to come by. Communication failed and trust with it, while pride swelled to passion. Gould being a member and protégé of the Lazzaroni, that formidable clique joined battle with the trustees, while its enemies in science rooted for its comeuppance. When the trustees dismissed Gould, he refused to vacate the premises. Both sides then sought the backing of law and government, and so existing political as well as business and social rivalries broadened the fray. Federal-state-private relationships were involved, along with questions of property rights, the moral issue of power without responsibility, and the rights and duties of professionalism.

For science, the contest raised issues of financing, international standing, the role of governments and elites, institutional development at a crucial time of crystallization, and the relationship between scientists and laymen (though not, as some have supposed, that of popularized versus serious science). To this reviewer's mind, the central issue, embracing several of the foregoing, was that of scientists' everlasting struggle for self-rule, freedom of research, or support without strings, as opposed to laymen's perennial reaction against condescension, arrogance, and the demand that laymen pay the piper without calling the tune. (In this case, the scientists eventually lost, and Gould was forcibly evicted.)

James deals ably with these tangled themes. Her research is broad and imaginative, yet thorough and meticulous. She writes clearly and vigorously, though some of her analytical passages could bear tightening and the finished product is flyspecked with typos, misspellings, and solecisms. As she proceeds to a blow-by-blow narrative, the details multiply. But her prose gathers momentum at that point, and the intrinsic drama of human conflict and passion engages the reader. Besides, those details illustrate and add nuances to her generalizations, and furthermore allow readers to draw inferences and conclusions of their own. All in all, this is an interesting, illuminating, and significant study.

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Particle Physics

Expanding Protons. Scattering at High Energies. HUNG CHENG and TAI TSUN WU. MIT Press, Cambridge, MA, 1987. xvi, 285 pp., illus. $40.

The publication of an entire book on the subject of high-energy diffraction scattering serves the valuable purpose of drawing attention to the remarkable fact that total cross sections of elementary particles apparently increase with increasing energy. The authors' opinion that this phenomenon is well understood theoretically, however, is probably not shared by all workers in the field. Nevertheless, the book provides a useful if short summary of both the existing experimental data and the existing theoretical framework in terms of which the data will, it is to be hoped, eventually be explained.

After an introduction to particle physics in general and gauge field theory in particular, the book turns to its principal purpose, describing the high-energy scattering of elementary particles. First a few low-order perturbation theory calculations are displayed, for orientation, and tower diagrams, the basic building blocks of the analysis, are introduced. There follow a short description of the physical picture of the scattering process, which is derived in a later chapter, and a review of various phenomenological models.

The meat of the book is in the latter part of it, from chapter 9 on. Here detailed calculations of large numbers of very complicated Feynman diagrams are presented. The purpose is to show that any theory with spin-one gauge particles will lead to cross sections saturating the theoretical upper limit—the Froissant bound— on their growth with energy. The work necessary to demonstrate this is overpowering; this is a book for dedicated experts.

Chapters 9 and 10 describe in detail the calculational techniques that are used. Chapter 11 uses these to compute the fermion-fermion scattering amplitude, through eighth order, and then revisits tower diagrams in more detail. This discussion is specialized for quark-quark scattering in chapter 12. Next, in chapter 13, all of the above is inserted into the eikonal formula (which is explained) to obtain the final result. Finally, even more exhaustive detail is presented in three appendixes.

For anyone actually wishing to indulge in the computation of high-energy limits of Feynman diagrams, the book is invaluable. The authors have invented many clever techniques for doing these calculations, and no other description of them is available.

However, for those interested more in an overview of high-energy scattering that emphasizes data and physical insight, this book is overkill. Instead of helping us to understand how the unique properties of quantum chromodynamics and the phenomenon of color confinement (surely nonperturbative) are connected to high-energy scattering, it concentrates exclusively on perturbation theory and summing diagrams. Its audience will therefore be limited, but for that group the book is an important addition to the literature.

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