and has allowed genuine electron holography to be demonstrated as a useful technique. We have good grounds to hope that the story of the next 50 years of electron diffraction will be just as exciting and interesting as the history to date.

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A Portrait

Night Thoughts of a Classical Physicist. RUSSELL MCCORMMACH. Harvard University Press, Cambridge, Mass., 1982. x, 220 pp., illus. $15.

This book uses a fictional format to describe a few days in the daily life of an old physics professor (including his reminiscences and dreams) at an unspecified Prussian university. The time is September 1918; the World War draws to a close, and other endings are also imminent. The professor is a composite figure: his thoughts, impressions, and recalled incidents are based upon historical records. He is reaching the end of a life spent in physics at a time when his guiding principle, the unifying world-ether, is losing its dominance. At the same time the self-confident political, social, and cultural values of German-speaking people are being brought into question, as are the institutions that embody them. The theme of suicide (exemplified by the cases of the physicists Ludwig Boltzmann and Paul Drude) keeps rising to the surface of the old professor's thoughts.

The book is authentic with regard to its time and place and its concern with the intellectual issues of the day. Russell McCormmach is a well-known historian of science; he has constructed his "classical physicist" with sensitivity, erudition, and skill, rounding out the picture with historical notes and a section on sources. His antihero, Viktor Jakob, is fussy, likable, and not very successful. A student of the physicist A. Kundt and of Hermann von Helmholtz, whom someone called the "Reich Chancellor of physics," Jakob holds a second-class position (honorary ordinary professor of theoretical physics) at a provincial university. He has had no control over experimental facilities, which could have given him higher prestige and greater opportunity for professional advancement. He suspects he may have suffered from having a Jewish-sounding name, although he is not Jewish.

Jakob is dominated by his overbearing director and believes he is treated with disrespect by the custodian of the physics institute. The latter abuses an old cat named Maxwell, whom Jakob befriends. (The cat dies, too.) Jakob has nightmares about lecturing to bored students while being observed by Friedrich Althoff, the Prussian Minister of Culture. Perhaps the university milieu was as petty and mean-spirited as is suggested, but the picture may be overdrawn.

The main thrust of the book is in the changes it rings on the meaning and status of classical physics, a decade or two into the relativistic and quantum physics revolutions (the latter being the more serious challenge). Jakob ponders these attacks on the classical world-order and then begins to list integrative themes (inertia, mass, charge, and so on). He contrasts classical and romantic styles in doing physics, as one sometimes does in art and literature. He harks back to the supposed affinity between the values of 19th-century Teutonic culture and those of the classical period of Greece.

The idea of this book as a possible new genre in science history is so appealing

The Balcony Room by Adolf von Menzel. "In Jakob's judgment, some artists' paintings had no more beauty than [the] spotted handkerchief [with which he had just wiped up a spill]. By beauty, then, he wasn't referring to the naive daubs of the Expressionists. (Their ideas were equally naive. They talked bombastically of unveiling the reality beneath the reality. Physicists had long known such talk was meaningless. . . .) Still less was he referring to paintings in the so-called Youth Style, with their undisciplined images. . . . No, he had in mind paintings with the shimmering clarity of Menzel's *Balcony Room*, which hung in reproduction in his study. . . . Menzel's little bourgeois interior gave Jakob the pleasure that his own study with its high curtained windows and always freshly waxed surfaces never failed to give him. (Through Helmholtz he had met Menzel in Berlin and later again in Italy, where Menzel was sketching a ship. Each nail must be in its place, each scratch, Menzel had explained. It impressed Jakob, who knew physicists with less conscience.)" [From *Night Thoughts of a Classical Physicist*] that I should like to recommend it to a large audience, but some reservations should be noted. The author has chosen not to make Jakob a "fully developed character in his social world," so that the book is not quite satisfactory as a novel. Also, even the readers of *Science* cannot be expected to recognize the names of relatively obscure physicists who enter the pages of this book with little introduction, along with giants like Max Planck and Albert Einstein. That being said, however, I recommend this book for its charm, its intensity, and its scholarship.

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Lectures in Particle Physics

The Nature of Matter. Wolfson College Lectures 1980. J. H. MULVEY, Ed. Clarendon (Oxford University Press), New York, 1981. xiv, 202 pp., illus. $15.95.

In the spring of 1980, eight lectures on the status of elementary particle physics were given at Oxford's Wolfson College. The cast of distinguished speakers consisted of Denys Wilkinson, Rudolf Peierls, C. H. Llewellyn Smith, D. H. Perkins, Abdus Salam, John Ellis, J. B. Adams, and Murray Gell-Mann. All have made important contributions to our understanding of the fundamental laws of nature and are well known for their ability to deliver clear narrations. J. H. Mulvey has collected and edited these talks in a neat, concise book that is a delightful survey of contemporary elementary particle physics.

I was impressed by all eight lectures; but I most enjoyed the two experimentally oriented papers, "Inside the proton" by Perkins and "The tools of particle physics" by Adams. The first is a lively account of the quest for the elusive quark. Although free quarks have never been observed and many physicists believe that they are permanently confined inside hadronic matter, deep-inelastic electron-proton scattering experiments have nevertheless managed to unveil their basic properties. Perkins explains in simple terms how such experiments have determined the fractional charge, spin (1/2), and "effective" masses of quarks. Those same experiments revealed a peculiar feature of quarks. Their interaction strength diminishes at short distances. This remarkable discovery inspired the development of quantum chromodynamics (QCD), the popular gauge theory of strong interactions. Perkins's description of this advancement in theory and experiment makes for very interesting reading.

In Adams's exposé on the tools of particle physics, the key adjective is big. Today's high-energy experiments are carried out by big collaborations (as many as 100 physicists) at big accelerators (several miles of circumference) using big detectors producing extremely large amounts of data. From his own firsthand experience, Adams provides a fascinating description of the unique world of today's high-energy experimental physicist. His paper also serves as a brief introduction to the next generation of even bigger accelerators (Large Electron-Positron, Isabelle, and Tevatron), which, when completed, will probe yet smaller distances.

The six theoretical papers are all clear, concise, and readable. They deal with the fundamental forces, attempts to unify these distinct interactions, proton decay, the use of symmetry in our attempts to understand nature, and the relationship between particle physics and big-bang cosmology. Together, the papers provide an up-to-date overview of the present theoretical scene.

The book concludes with Gell-Mann's lecture "Questions for the future." This is a witty monologue by one of the outstanding physicists of our day. It provides a nice perspective on how far theoretical physics has gone and what questions remain to be answered, particularly the question how do we unify gravity with the other fundamental forces? Having heard Gell-Mann speak on this subject at several colloquiums, I was delighted to finally see his thoughts and anecdotes in print.

In summary, *The Nature of Matter* is a well-written, informative collection of superb papers. I highly recommend it. It is particularly well suited for students and nonspecialists who seek a clear, concise overview of the recent progress in elementary particle physics. However, even the experts will be entertained by the book.

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New Instruments for Exploration

Telescopes for the 1980s. G. BURBIDGE and A. HEWITT, Eds. Annual Reviews, Palo Alto, Calif., 1981. x, 278 pp., illus. $27. Annual Reviews Monograph.

Astronomy is an observational science, critically dependent on the collection of photons from distant objects. The rapid advances of the past three decades have come about primarily in response to improved telescopes and detectors and expansion into previously unexplored regions of the electromagnetic spectrum. In the 1950's, the 200-inch telescope on Mount Palomar and the rapid development of radio astronomy led the way. The 1960's saw the impact of the new national observatories at Kitt Peak and Cerro Tololo, the introduction of electronic detectors, and the first successful observations in x-ray and ultraviolet from above the atmosphere. During the 1970's, the number of large optical telescopes in the world more than doubled, infrared and millimeter-wave astronomy came into their own, high-quantum-efficiency array detectors began supplanting photographic plates for optical work, interferometry and aperture-synthesis techniques enabled radio astronomy to achieve high spatial resolution, and high-energy astronomy from space revealed a variety of new phenomena. Astronomers now study a universe far more dynamic than any imagined a generation ago, one populated by molecular clouds, exploding galaxies, quasars, blazars, and black holes. Equally dynamic is the observer's quest for the new instruments needed to pursue this revolution—instruments that frequently require large resources of scarce federal research dollars as well as substantial technological innovation.

This book tells the story of the development of four major new astronomical instruments—or facilities, as such multiuser equipment tends to be called these days. Three of these represent the latest generation of radio, optical, and x-ray telescopes, each built during the late 1970's, and the fourth, the NASA Space Telescope, is still under development. The x-ray telescope, Einstein, has al-