novel terms are *radian* and *frequency.*) On the other hand, there are occasional illuminating flashes, some humor, and from our present point of view an undue reliance on crude mechanical analogies, some of which were turned into working models that were exhibited to the audience.

Most of the historical and philosophical essays in the centenary volume, especially the philosophical ones, are only loosely related to the Baltimore lectures (except inasmuch as science as a whole is unified). Howard Stein's essay on "the subsequent development of physics," that is, what followed the lectures, is an exception. Mainly dealing with the Lorentz electron theory, Stein objects to Thomas Kuhn's characterization of this theory as *normal* science, arguing that a theory that is incomplete (and in that sense a failure) can be revolutionary, providing it is convincing in its failure. Other philosophical essays deal with such concerns as parts and wholes (Abner Shimony), the ontology of space–time (Paul Teller), locality vs action at a distance (John Earman), the quantum measurement problem (Arthur Fine) and the older natural philosophy vs the modern metaphilosophy of science (Thomas Nickles).

M. Norton Wise and Crosbie Smith lay their emphasis on the practical side of Kelvin, who was a prodigious inventor and whose theory of the electric telegraph had convinced him of the existence of longitudinal ether waves. Peter M. Harman makes the point that Maxwell's electromagnetic theory was based on a hydrodynamic model, even though, like Kelvin, he sought also to realize it by a mechanical analogy. Lawrence Badash argues (unsurprisingly) that Ernest Rutherford, in spite of his good-natured joshing of theorists, was himself a part-time theorist, while Bruce J. Hunt describes G. F. Fitzgerald's unsuccessful attempts to make a Maxwellian out of Kelvin. On the whole, this is a stimulating, if somewhat heterogeneous work on the cultural side of physics.

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The Quantum Universe

Tony Hey and Patrick Walters
Cambridge U. P., New York, 1987. 180 pp.
$47.50 hc ISBN 0-521-26744-7; $16.95 pb ISBN 0-521-31845-9

Tony Hey and Patrick Walters believe that what the lay reader most wants to know about the quantum theory is its practical impact, and after that what it has to say about matter and the universe. With due acknowledgment of their debt to the late Richard Feynman, they freely adopt his pedagogical style and accept his philosophical (one might say *anti*-philosophical) stance.

The Quantum Universe has little to say about mystical implications of the quantum theory. Like Feynman, its authors simply accept that the quantum world is run by peculiar rules that thwart our feeble attempts to visualize it, because that's the way things are. Queer as they may be, these rules gave us the computer chip, lasers and nuclear energy, and enable us to understand the heart of a nucleus or of a collapsing star.

Also in the Feynman spirit, Hey and Walters would rather find an apt analogy to illuminate each topic than stick to a unified treatment. Roller coasters and pinball machines serve their purposes and then are discarded. One exception is double-slit interference (another Feynman favorite), a unifying theme that occurs several times in the text.

The book is lavishly illustrated both with color photographs and with line drawings far more vivid than the usual textbook fare. As a result, it has much of the feel of those marvelous BBC television science specials. Indeed, in places the text reads a bit like a TV script, skipping past sticky points with bursts of verbal legerdemain.

Hey and Walters are exceptionally attentive to history. Every child has heard of Albert Einstein and Niels Bohr, but John Bardeen and Heike Kamerlingh Onnes are hardly household names, and few outside the semiconductor industry are aware of how much we owe to Jack Kilby, Robert Noyce, Ted Hoff and the pioneers of the microchip.

Popularizers often drag their own work into the story, and for Hey this means gauge invariance, on which he has written an important monograph. Unfortunately, this hobbyhorse ride is quite out of place in this book. Though professionals may marvel at how much physics comes out of such a parsimonious assumption, the lay reader has no frame of reference from which to be similarly impressed. But other lapses into formalism are, by and large, confined to appendices, so that on the whole this is an exceptionally successful popularization for the many readers who love science for its wonders, but care little for its structure.

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NEW BOOKS

Astrophysics

The Cambridge Atlas of Astronomy. Second edition. J. Audouze, G. Israël, eds. Cambridge U. P., New York, 1988. 431 pp. $90.00 *hc* ISBN 0-521-36360-8. *Reference*

The Color Atlas of Galaxies. J. D. Wray. Cambridge U. P., New York, 1988. 189 pp. $79.50 *hc* ISBN 0-521-32236-7. *Reference*

Observer's Handbook 1989. R. L. Bishop, ed. Roy. Astron. Soc. Canada, Toronto (M5R 1V2), Canada, 1988. 224 pp. $10.00 *pb* ISSN 0080-4193. *Reference*

Uranometria 2000.0, Vol. 2: The Southern Hemisphere to +6°. W. Tirion, B. Rappaport, G. Lovi. Willmann–Bell, Richmond, Va., 1988. 473 pp. $35.00 *hc* ISBN 0-943396-15-8. *Reference*

Biophysics

Imaging Techniques in Biology and Medicine. *Physical Techniques in Biology and Medicine.* C. E. Swenberg, J. J. Conklin, eds. Academic, San Diego, Calif., 1988. 369 pp. $70.00 *hc* ISBN 0-12-679070-1. *Monograph compilation*

Introduction to Theoretical Neurobiology. *Cambridge Studies in Mathematical Biology 8.* H. C. Tuckwell. Cambridge U. P., New York, 1988. **Vol. 1: Linear Cable Theory and Dendritic Structure.** 291 pp. $49.50 *hc* ISBN 0-521-35096-4. **Vol. 2: Nonlinear and Stochastic Theories.** 265 pp. $49.50 *hc* ISBN 0-521-35217-7. *Monograph*

Nuclear Analytical Techniques in Medicine. *Techniques and Instrumentation in Analytical Chemistry 8.* R. Cesareo, ed. Elsevier, New York, 1988. 404 pp. Dfl 245.00 ($129.00) *hc* ISBN 0-444-42911-5. *Monograph compilation*

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Antiproton Science and Technology. Proc. Wksp., Santa Monica, Calif., October 1987. B. W. Augenstein, B. E. Bonner, F. E. Mills, M. M. Nieto, eds. World Scientific, Singapore (Teaneck, N. J.), 1988. 759 pp. $88.00 *hc* ISBN 9971-50-587-8

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Neutrino Physics. Proc. Wksp., Heidelberg, FRG, October 1987. H. V. Klapdor, B. Povh, eds. Springer-Verlag, New York, 1988. 333 pp. $55.90 *hc* ISBN 0-387-19254-9

Nuclear and Particle Physics Source Book. *Science Reference Series.* S. Parker, ed. McGraw–Hill, New York, 1988. 529 pp. $45.00 *hc* ISBN 0-07-045509-0

Physics at LEAR with Low Energy Antiprotons. *Nuclear Science Research Conference Series 14.* Proc. Wksp., Villars-sur-Ollon, Switzerland, September 1987. C. Amsler, G. Backenstoss, R. Klapisch, C. Leluc, D. Simon, L. Tauscher, eds. Harwood Academic, New York, 1988. 827 pp. $112.00 *hc* ISBN 3-7186-4814-8

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Vertex Detectors. *Ettore Majorana International Science Series 34.* Proc. Wksp., Erice, Italy, September 1986. F. Villa, ed. Plenum, New York, 1988. 367 pp. $75.00 *hc* ISBN 0-306-42798-2

Instrumentation

Advances in Magnetic Resonance, Vol. 12. J. S. Waugh, ed. Academic, San Diego, Calif., 1988. 438 pp. $88.00 *hc* ISBN 0-12-025512-X. *Compilation*

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Mathematical Methods

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Bombay Lectures on Highest Weight Representations of Infinite Dimensional Lie Algebras. *Advanced Series in Mathematical Physics 2.* V. G. Kac, A. K. Raina. World Scientific, Singapore (Teaneck, N. J.), 1987. 145 pp. $55.00 *hc* ISBN 0-9971-50-395-6; $28.00 *pb* ISBN 9971-50-396-4

Computational Techniques for Fluid Dynamics, Vols. 1–2. *Springer Series in Computational Physics.* C. A. J. Fletcher. Springer-Verlag, New York, 1988. $129.00 *hc* ISBN 0-387-19466-5. **Vol. 1: Fundamental and General Techniques.** 409 pp. $59.50 *hc* ISBN 0-387-18151-2. **Vol. 2: Specific Techniques for Different Flow Categories.** 484 pp. $69.50 *hc* ISBN 0-387-18759-6. *Text*

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CINDAS Data Series on Material Properties, Vol. 5: Part 1, Properties of Inorganic and Organic Fluids. P. E. Liley, T. Makita, Y. Tanaka; C. Y. Ho, ed. Hemisphere, New York, 1988. 309 pp. $80.00 *hc* ISBN 0-89116-802-8. *Reference compilation*

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Michael Atiyah: Collected Works, Vols. 1–5. M. Atiyah. Clarendon (Oxford U. P.), New York, 1988. **Vol. 1: Early Papers; General Papers.** 364 pp. $59.00 *hc* ISBN 0-19-853275-X. **Vol. 2: K-Theory.** 829 pp. $89.00 *hc* ISBN 0-19-853276-8. **Vol. 3: Index Theory, Part 1.** 593 pp. $79.00 *hc* ISBN 0-19-853277-6. **Vol. 4: Index Theory, Part 2.** 617 pp. $79.00 *hc* ISBN 0-19-853278-4. **Vol. 5: Gauge Theories.** 685 pp. $89.00 *hc* ISBN 0-19-853279-2

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Successful Engineering: A Guide to Achieving Your Career Goals. L. J. Kamm. McGraw-Hill, New York, 1989. 233 pp. $39.95 *hc* ISBN 0-07-033267-3 ■