

for the third instrument, the Diffuse Infrared Background Experiment. The DIRBE data, full-sky maps from 1.25 to 240 μm , are difficult to analyze, but they will bear fruit for years to come.

Mather takes great care to show that COBE's success is rooted in the dedication and insights of many engineers, scientists and technicians. The book does more than just associate names with events; it explicates the seminal concepts and visions behind COBE. This is an extremely difficult task. As Mather notes in the epilogue, although referring to a grander scale, "One may never be able to trace the ripples engendered by one small individual action among the many millions in the great human drama."

Although Mather's book contains some minor factual errors and omissions, a more thoughtful and accurate account would be difficult to imagine. Also, no doubt due to his modesty, we do not hear of many of Mather's contributions to COBE.

At times it seems as though the authors view their book as a counter to Smoot's version, centered on the DMR experiment (*Wrinkles in Time* by Smoot and Keay Davidson, Morrow, 1993; reviewed in *PHYSICS TODAY*, September 1994). For instance, the subtitle bills the book as "The True Inside Story," not just "The Story." This is unnecessary; the thoughtful prose and care taken in giving proper credit speak for themselves. For the outsider, the beautiful and important science from this very complex mission overwhelms the internal skirmishes. It is a triumph that so many could work together for so long to give us such wonderful results.

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The Life and Legacy of G. I. Taylor

George Batchelor
Cambridge U. P., New York, 1996.
285 pp. \$75.00 hc
ISBN 0-521-46121-9

As a graduate student in Cecil T. Lane and Lars Onsager's group in low-temperature physics at Yale University in the early 1950s, I had occasion to read an Onsager paper, from a conference in Kyoto in 1953, in which he stated: "In hydrodynamics generally, stability conditions are determined by the Reynolds number $R = vl/\nu$ where v stands for the velocity and l for the significant linear dimension of the flow and ν is the kinematic viscosity . . ." Knowing nothing about either hydro-

dynamic stability or kinematic viscosity, I trotted over to Lars's office to be enlightened. He informed me that hydrodynamic stability was a small field of physics being carried on by "a rare crew." The crew members were identified as Chia-Chiao Lin (at MIT), Subrahmanyan Chandrasekhar (at the University of Chicago) and Geoffrey Ingram Taylor (at the University of Cambridge). I had never heard of any of them; Lars undertook to introduce me to all three at meetings in New York City in early 1955. This was the beginning of my long acquaintance with these remarkable men. Thanks to George Batchelor, a research student of Taylor's who spent his career at Cambridge, we now have a satisfying biography of "GI," as his friends called him, in *The Life and Legacy of G. I. Taylor*.

GI was one of the greatest physical scientists who ever lived. He made monumental contributions to the fields of solid and fluid mechanics, meteorology, physical oceanography, fracture mechanics, plasticity, hydrodynamic stability, turbulence and much more. GI's forebears were themselves remarkable people. His father, Edward, was a noted artist, and his mother, Margaret, was the second daughter of George Boole, the founder of Boolean algebra. Margaret's mother was Mary Everest, niece of George Everest, one of the founders of geodesy and the man for whom the mountain was named.

Batchelor organized a memorable symposium in 1986, the 100th anniversary of GI's birth. He called it "Fluid Mechanics in the Spirit of G. I. Taylor." I doubt that any of us who spoke there could remotely fulfill the "spirit." GI did highly original and insightful research over many subjects and many years (1909–72). He had no secretary, never applied for a research grant and never took a sabbatical leave. He had an uncanny ability to select fundamental problems, to invent simple but powerful solutions to them and to do experiments on them, working by himself or with a single technician. Added to that, he had a sunny and generous personality that won him staunch and grateful friends all over the world.

To give an example of GI's style: He published a paper in 1923 entitled "Stability of a Viscous Liquid Contained between Two Rotating Cylinders." It is a theoretical analysis of the breakdown of laminar flow as the cylinders rotate ever more rapidly. The paper predicts the existence of what are now called Taylor vortices, which succeed the laminar flow, and reports a sophisticated experiment to illustrate, and photograph, the vortices described by the theory. The subject con-

tinues today to be of interest: There is a biannual workshop on Taylor vortices, now in its tenth iteration, and the intellectual legacy of this single paper easily surpasses 2000 references. (I discussed the early history of this subject in an article in *PHYSICS TODAY*, November 1991, page 32.)

Batchelor's book contains an illuminating note by the late Nevill Mott on the origin of the study of dislocations in crystalline solids, which is an important branch of solid state physics, and the role played by GI's pioneering ideas. (The article was written in 1976 as a contribution to the Royal Society biographical memoir of G. I. Taylor.) A chapter on turbulence, to which Batchelor himself has made many important contributions, examines the influence of GI's early investigations on this subject and in particular the relationship of his ideas to the later work of Andrei Kolmogorov, Werner Heisenberg, Carl von Weizsäcker and Onsager.

The rest of the book details the incredible contributions GI made as a consultant in the UK and at Los Alamos during World War II, his equally incredible second "golden" period of research after his "retirement" in 1951, and finally an assessment of GI's scientific legacy. It will come as no surprise to anyone remotely acquainted with that legacy that Taylor is quoted as saying, "... in general it seems to me that it is through particular problems which can be subjected to experimental verification or compared with natural phenomena that most advances are made."

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Symmetries in Quantum Physics

Ugo Fano and A. R. P. Rau
Academic, San Diego, 1996.
333 pp. \$59.95 hc
ISBN 0-12-248455-X

Traditionally the theory of angular momentum has played an important role in the education of physicists—offering a simple but nontrivial example of a continuous symmetry—and provided them with the requisite tools to sort out the spectroscopy and collision dynamics of atoms, nuclei and simple molecules. Toward this end, the late 1950s and early 1960s saw the appearance of many excellent, now-classic texts, such as those by M. E. Rose (*Elementary Theory of Angular Momentum*, Wiley, 1957), Allen R. Edmonds (*Angular Momentum in Quantum Mechanics*, Princeton U. P., 1957,