physics. The first is itinerant magnetism, which Coleman uses to illustrate an application of functional integrals. Next come two chapters on superconductivity that cover weak coupling BCS theory, retardation effects, p-wave pairing in ^{3}He, and d-wave pairing in lattice models.

The final three chapters focus on the problems of local moments in metals and of heavy-fermion physics. Coleman has made pioneering contributions to those topics, and readers can gain much insight here. He even discusses the hotly debated possibility of topological Kondo insulator behavior in samarium hexaboride. However, the discussion of topological insulators is much too brief and readers will have to turn elsewhere for a deeper understanding of topological states of quantum matter.

Despite its length, *Introduction to Many-Body Physics* does not cover several topics that could be included in a modern many-body physics course. Among them are the Bogolyubov Bose gas, the superfluid-to-Mott insulator transition in the Bose–Hubbard model, and the BCS-to-BEC (Bose–Einstein condensation) crossover—all problems of great relevance to ultracold-atom experiments. Nor does Coleman discuss one-dimensional systems, the fractional quantum Hall effect, or numerical methods for many-body problems, all of which rightly deserve books of their own.

Coleman concludes *Introduction to Many-Body Physics* with a short but insightful epilogue in which he summarizes challenges for the future, including many-body problems that cannot be understood within the Landau paradigms of broken symmetry and well-defined quasiparticles with conventional quantum numbers. A reader who has mastered the material in this excellent book should be in a strong position to take on problems that have resisted conventional solutions.

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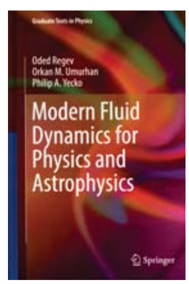
Modern Fluid Dynamics for Physics and Astrophysics



Oded Regev, Orkan M. Umurhan, and Philip A. Yecko

Springer, 2016. $119.00 (680 pp.). ISBN 978-1-4939-3163-7

It is hard to disagree with the authors of *Modern Fluid Dynamics for Physics and Astrophysics* when they write in their preface that fluid dynamics is a topic often neglected in undergraduate and even graduate physics courses. However, for many physicists—astrophysicists in particular—the Navier–Stokes equations are as fundamental for their daily work as quantum mechanics. In my experience, it is the students themselves who often ask for fluid dynamics courses in their curriculum.

Unfortunately, there seems to be a widespread and incorrect impression that hydrodynamics is a subject with little ongoing research. But as authors Oded Regev, Orkan Umurhan, and Philip Yecko point out, turbulence and nonlinear fluid instabilities are very much active areas of contemporary research, ones that physicists have often delegated to engineers. As a consequence, the courses in which fluid dynamics is taught tend to rely on classic textbooks such as *Fluid Mechanics* by Lev Landau and Evgeny Lifshitz (Pergamon Press, 1959) and *An Introduction to Fluid Dynamics* by George Batchelor (Cambridge University Press, 1967), which were first published more than half a century ago.

The textbook situation is a bit better in astronomy courses, in which fluid dynamics plays a fundamental role. Students and instructors can consult *Principles of Astrophysical Fluid Dynamics* by Cathie Clarke and Bob Carswell (Cambridge University Press, 2007) for a basic introduction aimed at undergraduates, and *Astrophysical Flows* by Jim Pringle and Andrew King (Cambridge University Press, 2007) for a more advanced approach that skips some fundamental concepts. When teaching fluid dynamics to undergraduates, I myself have often used the Clarke and Carswell book but always had to complement it with more advanced material to provide a broader view of the subject.

Modern Fluid Dynamics for Physics and Astrophysics is a welcome addition that helps fill the gap between introductory and advanced books. It covers important basic concepts that Clarke and Carswell omit, such as the Reynolds transport theorem, and exciting advanced topics, such as nonlinear instabilities.

The textbook includes several examples of astrophysical and geophysical applications of fluid dynamics that help the reader to put the theoretical concepts into specific contexts. Accretion disks and gravity waves on water surfaces, for example, are discussed extensively. Simple polytropic models for stellar structure are also covered, although not as thoroughly; the teacher who is interested in that specific topic might want to consult additional resources. The book includes an extensive and useful discussion of turbulence. The final chapter on magnetohydrodynamics is also particularly valuable, especially for astronomy students.

I did feel that numerical methods deserved a more comprehensive treatment than they received. Although the authors acknowledge that numerical methods are an important area of research in modern fluid dynamics, they only discuss them in a small, six-page appendix. That appendix concentrates on grid-based methods and neglects particle-based methods such as smoothed particle hydrodynamics, which are common in astrophysics.

The textbook is especially suited for graduate courses, but I believe that it can also be easily used for senior undergraduate courses. Given the breadth of the material covered, however, a typical one-semester undergraduate course might do well to concentrate on a few selected topics from the book.

In general, I find *Modern Fluid Dynamics for Physics and Astrophysics* to be a very good resource, not just for astrophysics and geophysics courses but for any physics course that covers the fundamental topic of fluid dynamics. Hopefully, this valuable book will help inspire physics departments to give fluid dynamics the role it deserves in the education of young physicists.

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