

K-meson decay are reduced to homework problems. Other good, recent pedagogical topics are left out, such as the neutron interferometer, Bell's theorem, and the Josephson effect. But an author has to pick and choose topics, so one can't really criticize him for the omissions.

My overall conclusion? It's good to have Merzbacher back. The second edition was getting seriously out of date. The third is a good, substantial, well-written text and will compete well with the other recent good texts out there. I have had good luck with the earlier editions of *Quantum Mechanics*, so I recommend that anyone looking for a first-year graduate text consider using it.

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## Classical Dynamics: A Contemporary Approach

Jorge V. José  
and Eugene J. Saletan  
Cambridge U. P., New York, 1998.  
670 pp. \$125.00 hc (\$54.95 pb)  
ISBN 0-521-63176-9 hc  
(0-521-63636-1 pb)

Classical mechanics has for years been the Cinderella of the graduate curriculum in many physics departments. Some departments have actually stopped teaching it. Recently, mainly as a result of the renewed interest in deterministic chaos (and the discovery that the warhorse of mechanics—the Solar System—falls into this category), there has been renewed interest in the subject, and the number of modern textbooks on classical mechanics is increasing. Many of these, however, require a familiarity with differential geometry, which has led to some reluctance to adopt them in many graduate schools. *Classical Dynamics*, by Jorge V. José and Eugene J. Saletan, should certainly redress this: It strikes the right balance between physical reasoning and mathematical sophistication, at the same time as it takes the reader to the forefront of active research in the field.

From the focus of the book, one can guess that the authors' backgrounds are in particle or plasma physics rather than celestial mechanics. José is the Matthews Distinguished University Professor and director of the Center for Interdisciplinary Research on Complex Systems at Northeastern University. Saletan, a professor emeritus of physics at Northeastern, is coauthor with Alan Cromer of *Theoretical Mechanics* (Wiley, 1971) and with Giuseppe Marmo, Alberto Simoni,

and Bruno Vitale of *Dynamical Systems* (Wiley, 1985).

*Classical Dynamics*, a rather hefty book, can be used as a textbook and as a reference on newer topics in mechanics. It does not confine itself to particle mechanics, and it contains an interesting chapter on continuum mechanics and nonlinear field theory. It introduces the reader along the way to some of the differential geometric aspects of Lagrangian and Hamiltonian mechanics, without getting too involved in the mathematical nitty-gritty. It contains a wealth of worked examples and interesting problems, the solutions to which are available (to instructors) on DOS or Macintosh diskettes in PDF format.

Some of the book's refreshing features bear mentioning. Instead of the usual presentation, starting from Newton's laws or Hamilton's principle, Newton's laws are "derived" (in the spirit of Ernst Mach) by analyzing momentum conservation in two-particle interactions in an inertial frame. Mass thus appears naturally via mass ratios, and force is treated as it should be, as acceleration. The notions of stability and chaos appear as early as page 10.

The book moves on briskly to the Lagrangian treatment of constrained problems, and the notions of manifold and tangent bundle appear in chapter 2, with lots of good illustrations to facilitate understanding. Motion of charged particles in electromagnetic fields is used to illustrate gauge invariance.

The chapter on variational principles is succinct but discusses such difficult topics as nonholonomic constraints and dissipation with much greater clarity than do most textbooks I know. The chapter ends with a discussion of Noether's theorem and active and passive symmetry transformations.

There is a nice chapter on classical and inverse scattering, including chaotic scattering (with an easy introduction to fractal dimensions). A useful application is the scattering of a charge by a magnetic dipole (the Störmer problem). The chapters on Hamiltonian dynamics, canonical transformations, and completely integrable systems are clear and easy to read. The Kolmogorov–Arnold–Moser (KAM) theory is clearly explained, based on a presentation of Jean Belissard and preceded by good examples of deterministic chaos. The necessary number-theoretic concepts are explained in an appendix.

Recent interesting developments, such as the Hannay angle, are also introduced. A brief chapter on the rigid body is followed by a nice chapter on continuum theories, nonlinear field theories, and solitons. Starting with the Sine–Gordon equation as the con-

tinuum limit of a chain of coupled pendulums, the authors introduce the reader to Maxwell's equations, some special relativity, solitons, and the Euler and Navier–Stokes equations.

The book is nicely typeset and printed on an ivory-colored, heavy-textured paper that is pleasant to the sight and touch, and the illustrations are very good. There are few if any obvious mistakes and surprisingly few misprints (most of them in proper names). I highly recommend this book to instructors and students alike.

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## The Defining Years in Nuclear Physics: 1932–1960s

Milorad Mladjenović  
IOP, Philadelphia, 1998. 441 pp.  
\$150.00 hc ISBN 0-7503-0472-3

A complete history of nuclear physics is sorely needed. I say "sorely" because of all the remarkable accomplishments made since the discovery of the neutron in 1932. During this period, the existence of the mean field as represented by the shell model and the optical model was established, showing that the mean field is a good approximation in spite of the strong interactions between the constituent particles.

Nuclei were found to have deformed shapes and thus exhibited rotational and vibrational spectra and, of course, the ultimate deformation of fission. Compound nuclear resonances were discovered before World War II; the surprising giant resonances followed later. The short interaction time reactions (direct reactions) were differentiated from the long interaction time reactions (compound nuclear reactions), later, intermediate time reactions (multistep reactions) were included in the description of reactions.

It was found that highly resolved nuclear cross sections are chaotic (although that term was not used), and successful stratagems that extracted the signal from the noise were devised. Their first application led to the optical model in 1954. I shall stop this listing at this point; I could cite many more examples, not the least of which are the weak interactions.

Milorad Mladjenović's *The Defining Years in Nuclear Physics: 1932–1960s* does not, of course, cover the history of all of these various research directions in detail. The author's choices are rather idiosyncratic, governed mostly by his research interests. There are extensive discussions of nuclear instruments (pages 83 to 209) and the theory