IOPscience iopscience.iop.org

Home Search Collections Journals About Contact us My IOPscience

Book review

This content has been downloaded from IOPscience. Please scroll down to see the full text.

2014 Class. Quantum Grav. 31 159001

(http://iopscience.iop.org/0264-9381/31/15/159001)

View the table of contents for this issue, or go to the journal homepage for more

Download details:

IP Address: 194.94.224.254
This content was downloaded on 03/09/2014 at 17:28

Please note that terms and conditions apply.

IOP Publishing Classical and Quantum Gravity
Class. Quantum Grav. **31** (2014) 159001 (1pp) doi:10.1088/0264-9381/31/15/159001

Book review

Relativistic Hydrodynamics
Luciano Rezzolla and Olindo Zanotti
2013, Oxford University Press
752 pp, UK £55 (hardback)
ISBN: 978-0-19-852890-6

The book by Rezzolla and Zanotti offers a comprehensive and detailed coverage of the theory, numerical methods and applications of relativistic hydrodynamics. Its breadth and depth are impressive and will likely make it a classic text in the field.

The discussion of fluids starts with the basic concepts of relativistic kinetic theory, and the treatment of equations of state includes various limits of the ideal fluid description for both fermions and bosons, the only omission being modern, high-temperature microphysical equations of state, which are used in numerical simulations of compact objects.

The main theorems governing relativistic fluids are covered in detail and alternative approaches (such as the velocity-potential approach) are also presented. Readers will also benefit from the presentation of the main ideas of a multifluid description. The chapter on nonlinear waves and shocks is very complete and of high pedagogical value. The graphical presentation of the main concepts makes it one of the most appealing introductions one can find on this subject. Special attention is paid to a relativistic description of reaction fronts, a subject that is otherwise hard to find in textbooks. Readers are also introduced to the most recent relativistic theories for non-perfect fluids.

The section on numerical methods starts with a discussion of the most successful modern approaches in numerical relativity, including a reference-style presentation of the main set of the relativistic equations of motion for fluids. The standard finite difference methods are reviewed, including a discussion of their stability and of convergence tests. The chapters on high-resolution shock-capturing methods and high-order methods are of exceptional clarity and offer step by step instructions on the implementation of various numerical methods for relativistic hydrodynamics. It is a perfect introduction for new graduate students entering the field, who will also benefit from some common practices discussed in an appendix.

The third part of the book presents a comprehensive collection of applications of relativistic hydrodynamics in astrophysics (accretion onto compact objects, disks and tori, relativistic jets, rotating stars and mergers of compact objects) as well as examples of its application in relativistic heavy-ion collisions. Several of these applications can serve as standard tests for new numerical codes.

The book leaves little to wish for, and for readers who now enter the field of numerical relativistic hydrodynamics it will become an invaluable companion in their career as researchers.

Nikolaos Stergioulas

Department of Physics, Aristotle University of Thessaloniki, Greece

E-mail: niksterg@auth.gr

 © 2014 IOP Publishing Ltd Printed in the UK