RADIATION HYDRODYNAMICS

Radiation Hydrodynamics studies the dynamics of matter interacting with radiation, when the radiation is strong enough to have a profound effect on the matter. It applies to normal stars, to exploding stars or stars with violent winds, to active galaxies, and on Earth wherever matter is very hot. This broad and up-to-date treatment provides an accessible introduction to the theory and the large-scale simulation methods currently used in radiation hydrodynamics. Chapters cover all the central topics, including: a review of the fundamentals of gas dynamics; methods for computational fluid dynamics; the theory of radiative transfer and of the dynamical coupling of matter and radiation; and quantum mechanics of matter–radiation interaction. Also covered are: the details of spectral line formation out of thermodynamic equilibrium; the theory of refraction and transfer of polarized light and current computational methods for radiation transport; and a description of some notable applications of the theory in astrophysics and laboratory plasmas. This is a valuable text for research scientists and graduate students in physics and astrophysics.

JOHN CASTOR received a Ph.D. in astronomy from the California Institute of Technology in 1967 for work involving radiation hydrodynamics in pulsating stars. He then joined the University of Colorado and the Joint Institute for Laboratory Astrophysics, where he worked on the foundations of radiation hydrodynamics and spectral line formation in high-velocity flows. This led to a very successful theory of radiatively-driven stellar winds. Since 1981 he has been a physicist at the Lawrence Livermore National Laboratory in California, working on problems in high-energy-density physics, including the interpretation of experiments with high-power lasers.

RADIATION HYDRODYNAMICS

JOHN I. CASTOR
Lawrence Livermore National Laboratory

CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo

Cambridge University Press
The Edinburgh Building, Cambridge CB2 2RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9780521833097

First published in print format 2004

ISBN-13 978-0-511-53618-2 OCeISBN

ISBN-13 978-0-521-83309-7 hardback
ISBN-10 0-521-83309-4 hardback