CAMBRIDGE

Astronomy, Astrophysics and Planetary Science 2010

Highlights

Gravity's Fatal Attraction

Black Holes in the Universe

Second edition

Mitchell C. Begelman
University of Colorado, Boulder

and Martin Rees
University of Cambridge

Richly illustrated in colour, this book is suitable for introductory undergraduate courses, amateur astronomers, and all readers interested in astronomy and physics. It shows how black holes were discovered, and discusses current understanding of their role in cosmic evolution. This second edition covers new discoveries made in the past decade.

'Martin Rees and Mitchell Begelman have provided us with a dramatic, elegant, and fully authoritative account of [black holes], and how they fit into our modern picture of the Universe.'

Roger Penrose, author of *The Emperor's New Mind*

Contents

Contents: 1. Gravity triumphant; 2. Stars and their fates; 3. Black holes in our backyard; 4. Galaxies and their nuclei; 5. Quasars and kin; 6. Jets; 7. Blasts from the past; 8. Black holes in hibernation; 9. Cosmic feedback; 10. Checking up on Einstein; 11. Through the horizon; Appendix: Gravity and cosmic dimensions; Index.

2010 246 x 189 mm 312pp
978-0-521-88944-5 Hardback £60.00
978-0-521-71793-9 Paperback £19.99
www.cambridge.org/9780521889445

TEXTBOOK

Astrophysics for Physicists

Arnab Rai Choudhuri
Indian Institute of Science, Bangalore

Designed for teaching astrophysics to physics students at advanced undergraduate or beginning graduate level, this textbook develops astrophysics from the basics without requiring any previous study in astronomy or astrophysics. Topics not usually covered in physics courses, such as general relativity and plasma physics, are developed from first principles.

'At last! An astrophysics textbook for physics majors that does not shy away from fluids, plasmas, and general relativity. With transparent physical reasoning and beautifully clear writing throughout, this book should become the standard for advanced undergraduate courses, and recommended reading for beginning graduate students. An outstanding complement to Choudhuri's previous masterwork, *The Physics of Fluids and Plasmas*.'

Mitchell C. Begelman, University of Colorado

Contents: 1. Introduction; 2. Interaction of radiation with matter; 3. Stellar astrophysics I: basic theoretical ideas and observational data; 4. Stellar astrophysics II: nucleosynthesis and other advanced topics; 5. End states of stellar collapse; 6. Our galaxy and its interstellar matter; 7. Elements of stellar dynamics; 8. Elements of plasma astrophysics; 9. Extragalactic astronomy; 10. The spacetime dynamics of the Universe; 11. The thermal history of the Universe; 12. Elements of tensors and general relativity; 13. Some applications of general relativity; 14. Relativistic cosmology; Appendixes; References; Index.

2010 247 x 174 mm 490pp
126 b/w illus. 88 exercises
978-0-521-81553-6 Hardback £35.00
www.cambridge.org/9780521815536

GRADUATE TEXTBOOK

Planetary Sciences

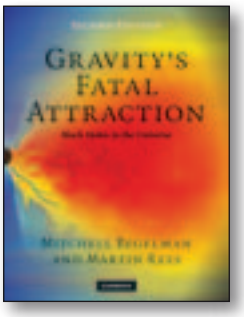
Second edition

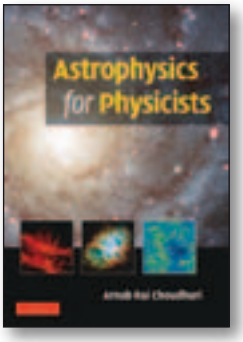
Imke de Pater
University of California, Berkeley

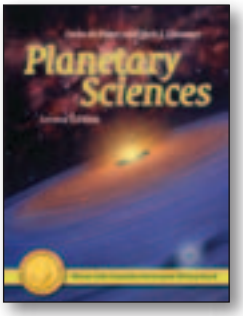
and Jack J. Lissauer
NASA Ames Research Center, Moffett Field, California

An authoritative introduction for graduate students in the physical sciences, this textbook has been substantially updated and improved. With over 300 exercises, it is ideal for courses in astronomy, planetary science and earth science. Color versions of many figures and movie clips supplementing the text are available at www.cambridge.org/9780521853712.

'The second edition keeps pace with the new discoveries in planetary science. It still has the classic figures and tables, but it also has spectacular new images and new theories. More space is devoted to derivations, so







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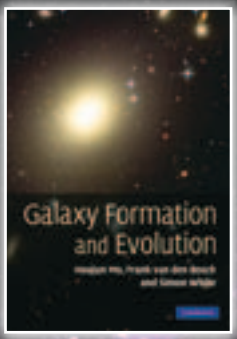

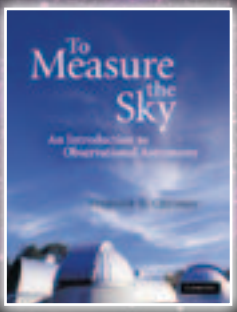

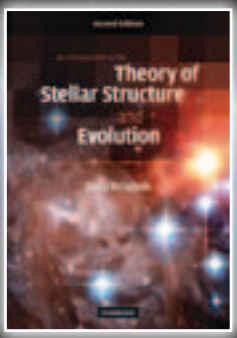

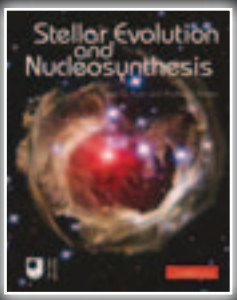

students can learn the material on their own. The book works at many levels, and I will continue to use it in my courses.'

Andrew P. Ingersoll, California Institute of Technology

Contents: Preface; 1. Introduction; 2. Dynamics; 3. Solar heating and energy transport; 4. Planetary atmospheres; 5. Planetary surfaces; 6. Planetary interiors; 7. Magnetic fields and plasmas; 8. Meteorites; 9. Minor planets; 10. Comets; 11. Planetary rings; 12. Extrasolar planets; 13. Planet formation; Appendices; References; Index.

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487 b/w illus. 43 colour illus. 48 tables 318 exercises
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Publication June 2010
www.cambridge.org/9780521853712

GRADUATE TEXTBOOK

Galaxy Formation and Evolution

Houjun Mo
University of Massachusetts, Amherst

Frank van den Bosch
The University of Utah

and Simon White
MPI fur Astrophysik, Munchen

Covering diverse topics from astronomy, particle physics, and cosmology, this book is ideal for researchers entering the field. Emphasizing both observational and theoretical aspects, the book provides a coherent introduction to the broad range of science underlying the formation and evolution of galaxies.

Contents: 1. Introduction; 2. Observational facts; 3. Cosmological background; 4. Cosmological perturbations; 5. Gravitational collapse and collisionless dynamics; 6. Probing the cosmic density field; 7. Formation and structure of dark matter halos; 8. Formation and evolution of gaseous halos; 9. Star formation in galaxies; 10. Stellar populations and chemical evolution; 11. Disk galaxies; 12. Galaxy interactions and transformations; 13. Elliptical galaxies; 14. Active galaxies; 15. Statistical properties of the galaxy population; 16. The intergalactic medium; Appendices; References; Index.

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160 b/w illus.
978-0-521-85793-2 Hardback £50.00
Publication June 2010
www.cambridge.org/9780521857932

TEXTBOOK

High Energy Astrophysics

Third edition

Malcolm S. Longair
University of Cambridge

The third edition of this well-established textbook is ideal for advanced undergraduate and beginning graduate courses in high energy astrophysics. Now consolidated into a single-volume treatment, this textbook has been completely rewritten, providing a strong astronomical and astrophysical background for students to explore more advanced topics.

Contents: **Part I.** Astronomical Background: 1. High energy astrophysics – an introduction; 2. The stars and stellar evolution; 3. The galaxies; 4. Clusters of galaxies; **Part II.** Physical Processes: 5. Ionisation losses; 6. Radiation of accelerated charged particles and bremsstrahlung of electrons; 7. The dynamics of charged particles in magnetic fields; 8. Synchrotron radiation; 9. Interactions of high energy photons; 10. Nuclear interactions; 11. Aspects of plasma physics and magnetohydrodynamics; **Part III.** High Energy Astrophysics in our Galaxy: 12. Interstellar gas and magnetic fields; 13. Dead stars; 14. Accretion power in astrophysics; 15. Cosmic rays; 16. The origin of cosmic rays in our galaxy; 17. The acceleration of high energy particles; **Part IV.** Extragalactic High Energy Astrophysics: 18. Active galaxies; 19. Black holes in the nuclei of galaxies; 20. The vicinity of the black hole; 21. Extragalactic radio sources; 22. Compact extragalactic sources and superluminal motions; 23. Cosmological aspects of high energy astrophysics; Appendix; References; Index.

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www.cambridge.org/9780521756181

Astronomy and Astrophysics

TEXTBOOK

To Measure the Sky

An Introduction to Observational Astronomy

Frederick R. Chromey
Vassar College, New York

With a lively yet rigorous and quantitative approach, this textbook introduces the fundamental topics in optical observational astronomy for undergraduates. It explains the theoretical foundations for observational practices and reviews essential physics to support students' mastery of the subject. Student understanding is strengthened through over 120 exercises and problems.

'I like this book a lot and think it is a valuable contribution to the education of undergraduates. It is a wide-ranging and thorough survey of the techniques common to astronomical observing in the optical and infrared wavelengths … The treatment throughout is both accurate and responsible. I know of no comparable book.'

Jay M. Pasachoff, Williams College

Contents: 1. Light: particles, waves and rays, magnitudes, spectra; 2. Uncertainty: statistics; 3. Place, time and motion: coordinate systems, timekeeping, proper motion; 4. Names, catalogs, atlases and databases: web resources; 5. Astronomical optics: geometric optics, materials, cameras, fibers, aberrations; 6. Telescopes: ground, space, ELTs, adaptive optics; 7. Matter and light: atomic and molecular spectra, solid-state absorption; 8. Detectors: CCDs, IR arrays, bolometers; 9. Digital images from arrays: image processing, digital photometry; 10. Photometry: extinction, standard systems; 11. Spectrometry; Appendices; Index.

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Publication June 2010
www.cambridge.org/9780521763868

TEXTBOOK

An Introduction to the Theory of Stellar Structure and Evolution

Second edition

Dina Prialnik
Tel-Aviv University

A stimulating introduction for undergraduates in astronomy, physics and mathematics, this second edition contains two new chapters and new exercises.

'The unique feature of this book is the emphasis it places, throughout, on the basic physical principles governing stellar evolution. The processes are always explained in the simplest terms, while maintaining full mathematical rigour … This textbook provides a stimulating introduction for undergraduates in astronomy, physics, planetary science, and applied mathematics who are taking a course on the physics of stars. Because this book requires only basic undergraduate physics and mathematics and no prior knowledge of astronomy it may be read by advanced amateurs as well.'

Orion

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TEXTBOOK

Stellar Evolution and Nucleosynthesis

Sean G. Ryan
University of Hertfordshire
and Andrew J. Norton
The Open University, Milton Keynes

This self-contained astrophysics textbook for advanced undergraduates explores how stars form, what happens to them as they age, and what becomes of them when they die. It contains a wealth of worked examples, exercises with full solutions, full colour illustrations, and clearly identified summaries, key facts and equations.

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TEXTBOOK

Extreme Environment Astrophysics

Ulrich Kolb
The Open University, Milton Keynes

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2010 263 x 210 mm 256pp 60 colour illus. 50 exercises
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Publication May 2010
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TEXTBOOK

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Carole A. Haswell
The Open University, Milton Keynes

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2010 263 x 210 mm 300pp 60 colour illus. 50 exercises
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Publication July 2010
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GRADUATE TEXTBOOK

Nucleosynthesis and Chemical Evolution of Galaxies

Second edition
Bernard E. J. Pagel

A lucid introduction for advanced undergraduates and graduate students, and an authoritative overview for researchers and professional scientists.

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C. R. Kitchin, *Astronomy Now*

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Unique reference for graduate students and researchers addressing common problems and methods in studying galaxy, star and planet formation.

Cambridge Contemporary Astrophysics

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Space Telescope Science Institute Symposium Series, 20

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Andrea Milani
Università degli Studi, Pisa
and Giovanni F. Gronchi
Università degli Studi, Pisa

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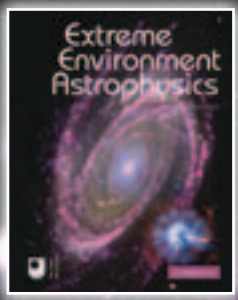

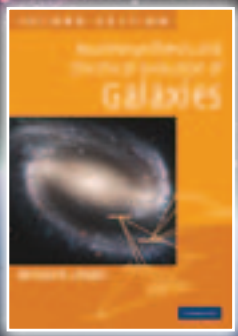

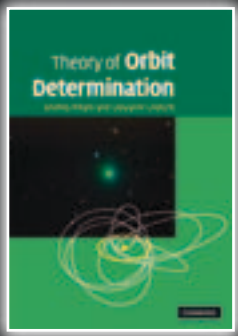

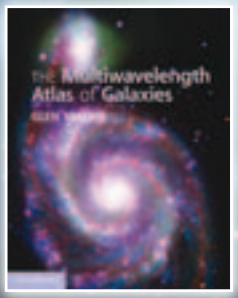

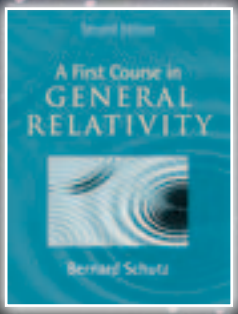

X-ray Polarimetry

A New Window in Astrophysics

Edited by Ronaldo Bellazzini
Istituto Nazionale di Fisica Nucleare (INFN), Rome

Enrico Costa
Istituto di Astrofisica Spaziale, Frascati, Italy

Giorgio Matt
Università degli Studi Roma Tre

and Gianpiero Tagliaferri
Istituto Nazionale di Astrofisica, Rome

Presenting detailed papers as well as broad reviews, this volume provides a complete and up-to-date view of X-ray polarimetry for researchers in astrophysics. The contributors discuss the present status and perspectives of instruments, review current theoretical models, and examine future missions.

Cambridge Contemporary Astrophysics

2010 247 x 174 mm 360pp
240 b/w illus.
978-0-521-19184-5 Hardback c. £70.00
Publication June 2010
www.cambridge.org/9780521191845

Rotating Relativistic Stars

John L. Friedman
University of Wisconsin, Milwaukee

and Nikolaos Stergioulas
University of Thessaloniki, Greece

Incorporating over 40 years of research, this volume provides graduate students and researchers with a self-contained treatment of the structure, stability and oscillations of rotating neutron stars. The equations of stellar equilibrium, key approximations and stability theory are covered, as well as numerical methods for computing equilibrium configurations.

Cambridge Monographs on Mathematical Physics

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978-0-521-87254-6 Hardback c. £70.00
Publication December 2010
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AGN Feedback in Galaxy Formation

Edited by Vincenzo Antonuccio-Delogu
Istituto Nazionale di Astrofisica (INAF), Catania, Italy

and Joseph Silk
University of Oxford

Featuring contributions from well-respected researchers in the field, and bringing together work by specialists in both galaxy formation and AGN, this volume addresses a number of key questions about AGN feedback in the context of galaxy formation. It is intended for use by both researchers and graduate students in astrophysics.

Cambridge Contemporary Astrophysics

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Publication October 2010
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Multiwavelength Atlas of Galaxies

Glen Mackie
Swinburne University of Technology, Victoria

Since the radio signature of our own Milky Way was detected in 1931, galaxies have been observed from ultra-high energy gamma rays to long wavelength radio waves, providing fundamental insights into their formation, evolution and structural components. Unveiling the secrets of some of the best-observed galaxies, this atlas contains over 300 full-color images spanning the whole electromagnetic spectrum. The accompanying text explains why we see the component stars, gas and dust through different radiation processes, and describes the telescopes and instruments used. This atlas is a valuable reference resource on galaxies for students seeking an overview of multiwavelength observations and what they tell us, and researchers needing detailed summaries of individual galaxies. An accompanying website, hosted by the author, contains slide shows of the galaxies covered in the book. This is available at www.cambridge.org/9780521620628.

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Publication November 2010
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Exploring the X-ray Universe

Second edition

Frederick D. Seward
Harvard-Smithsonian Center for Astrophysics

and Philip A. Charles
South African Astronomical Observatory, Sutherland

Capturing the excitement and accomplishments of X-ray astronomy, this second edition now includes a broader range of astronomical phenomena and dramatic new results from the most powerful X-ray telescopes. Ideal for undergraduate students, it is supported by over 300 figures, and more specialized technical points separated in boxes.

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Publication July 2010
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Cosmology and General Relativity

TEXTBOOK

A First Course in General Relativity

Second edition

Bernard Schutz
Max-Planck-Institut für Gravitationsphysik, Germany

Second edition of a widely-used textbook providing the first step into general relativity for undergraduate students with minimal mathematical background.

'Bernard Schutz's textbook *A First Course in General Relativity* quickly became a classic, notable for its use of the geometrical approach to the subject, combined with a refreshing succinctness. Since its first publication in 1985, the field of general relativity has exploded, with new discoveries in astrophysics and cosmology, and with the successful operation of laser interferometric gravitational-wave antennae. Schutz has done a masterful job of incorporating these new developments into a revised edition, which is sure to become a new 'classic'. I look forward to teaching out of the second edition of *First Course*.'
Clifford M. Will, McDonnell Center for the Space Sciences, Washington University, St Louis

Contents: Preface; 1. Fundamental principles of special relativity; 2. Vector analysis in special relativity; 3. Tensor analysis in special relativity; 4. Perfect fluids in special relativity; 5. Preface to curvature; 6. Curved manifolds; 7. Physics in a curved spacetime; 8. The Einstein field equations; 9. Gravitational radiation; 10. Spherical solutions for stars; 11. Schwarzschild geometry and black holes; 12. Cosmology; References; Index.

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An Introduction to Relativity

Jayant V. Narlikar
Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India

Simple and user-friendly, this introduction is ideal for a first course in the subject as part of undergraduate and graduate studies in physics, astrophysics and applied mathematics. It presents all the necessary information, and contains several worked examples, figures and

180 exercises to develop students' understanding of the subject.

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GRADUATE TEXTBOOK

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Foundations and Frontiers

T. Padmanabhan
Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India

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Contents: 1. Special relativity; 2. Scalar and electromagnetic fields in special relativity; 3. Gravity and spacetime geometry: the inescapable connection; 4. Metric tensor, geodesics and covariant derivative; 5. Curvature of spacetime; 6. Einstein's field equations and gravitational dynamics; 7. Spherically symmetric geometry; 8. Black holes; 9. Gravitational waves; 10. Relativistic cosmology; 11. Differential forms and exterior calculus; 12. Hamiltonian structure of general relativity; 13. Evolution of cosmological perturbations; 14. Quantum field theory in curved spacetime; 15. Gravity in higher and lower dimensions; 16. Gravity as an emergent phenomenon; Notes; Index.

2010 247 x 174 mm 728pp
34 b/w illus. 228 exercises
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TEXTBOOK

Introduction to General Relativity

Lewis Ryder
University of Kent, Canterbury

Student-friendly, well illustrated textbook for advanced undergraduate and beginning graduate students in physics and mathematics.

'This superb and spirited modern introduction to Einstein's theory of gravitation covers all of the essential topics with admirable clarity. A penetrating discussion of the basic concepts of the theory is followed by a wonderfully lucid development of the mathematical formalism using modern differential geometry. Ample illustrations and problems enhance and complement the text; moreover, a generous list of references is provided at the end of each chapter for further reading. This scholarly yet accessible textbook is highly recommended for a course on general relativity.'
Bahram Mashhoon, University of Missouri

Contents: Preface; Notation; Important formulae and physical constants; 1. Introduction; 2. Special relativity, non-inertial effects and electromagnetism; 3. Differential geometry I: vectors, forms and absolute differentiation; 4. Differential geometry II: geodesics and curvature; 5. Einstein field equations, the Schwarzschild solution and experimental test of general relativity; 6. Gravitomagnetic effects: gyroscopes and clocks; 7. Gravitational collapse and black holes; 8. Action principles, conservation laws and the Cauchy problem; 9. Gravitational radiation; 10. Cosmology; 11. Gravitation and field theory; References; Index.

2009 246 x 189 mm 458pp
1 b/w illus. 46 exercises
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TEXTBOOK

Relativity, Gravitation and Cosmology

Robert Lambourne
The Open University, Milton Keynes

Aimed at advanced undergraduates, this self-contained textbook covers the key ideas of special and general relativity and their applications. In full colour, it contains numerous worked examples and exercises with solutions. Key points and equations are highlighted, and each chapter ends with a summary list of important concepts and results.

Contents: 1. Special relativity and spacetime; 2. Special relativity and physical laws; 3. Geometry and curved spacetime; 4. General relativity; 5. The Schwarzschild solution and black holes; 6. Testing general relativity; 7. Cosmological solutions; 8. Our Universe; Index.

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TEXTBOOK

Observational Cosmology

Stephen Serjeant
The Open University, Milton Keynes

A comprehensive and up-to-date treatment of observational cosmology, this advanced undergraduate textbook enables students to use quantitative physical methods to understand the Universe. It contains full-colour figures, worked examples, exercises with solutions, and clearly identifiable key facts and equations. Suggestions for further reading provide jumping-off points for further study.

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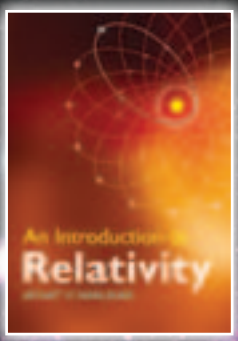

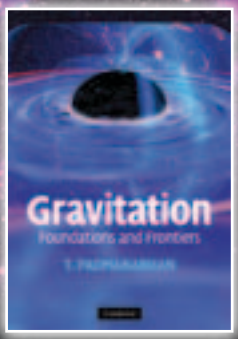

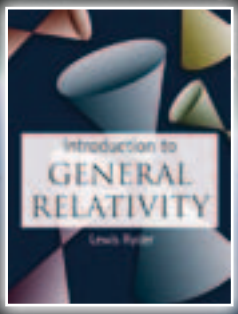

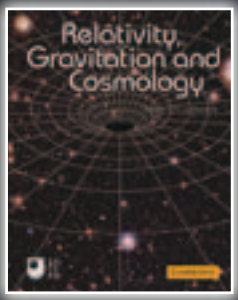

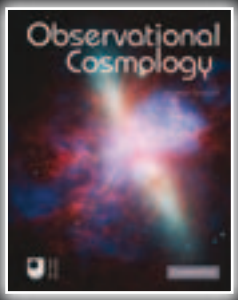

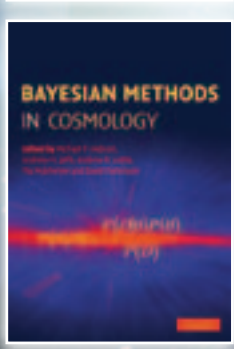

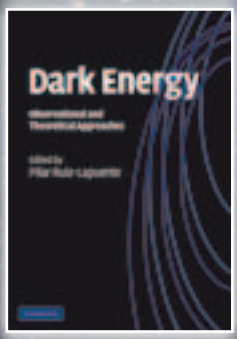

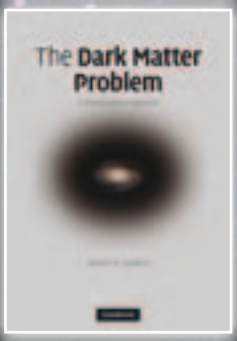

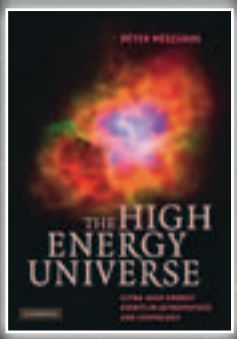

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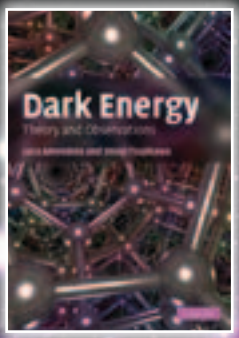

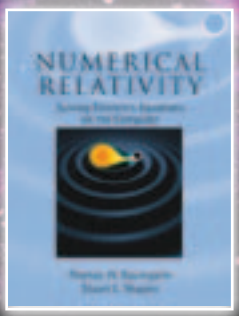

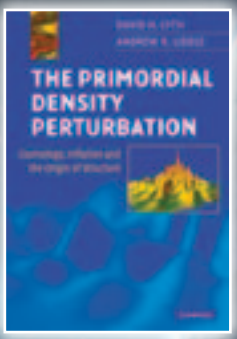

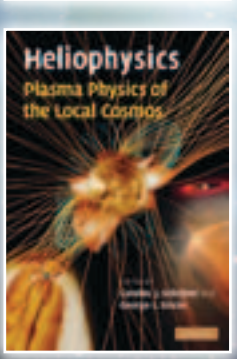

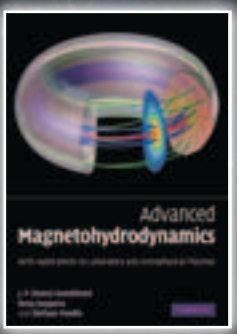

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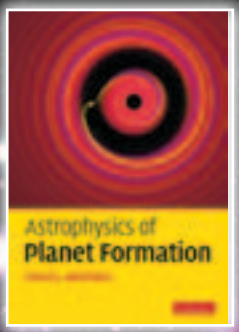

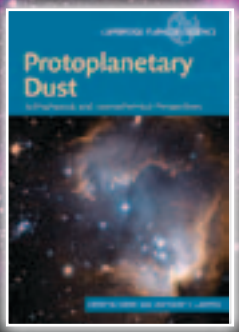

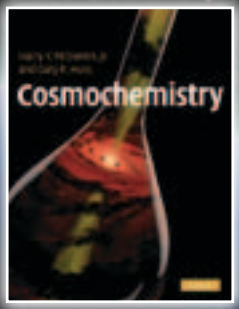

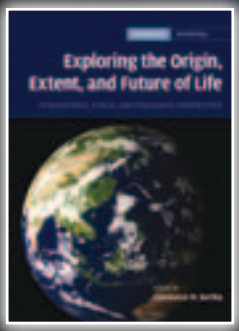

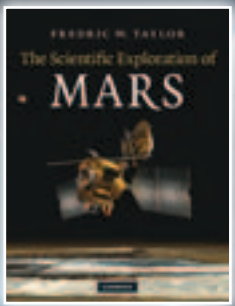

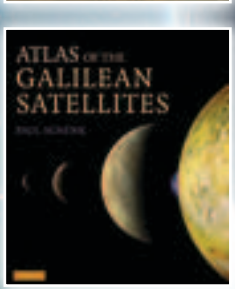

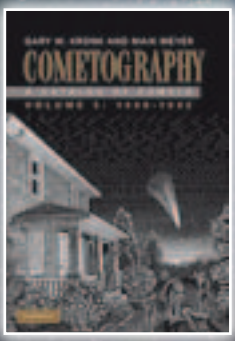

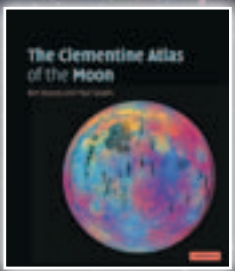

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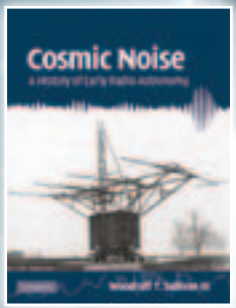

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