

in fundamental physics with our experience of time as situated, thinking, acting observers embedded in a particular physical universe. The section covers several aspects, from the rather technical to the deeply humanistic. Primarily, the discussions are both enlightening and, I'd hold, the right way to think about those issues, although a few topics, such as thermal time, occupy a frustrating ground between too technical and not technical enough.

I was intrigued but unconvinced by Rovelli's scheme to avoid the so-called "past hypothesis," which defines the early universe as one occupying an extraordinarily low-entropy state. Entropy growth underlies time, which, as Rovelli eloquently expresses, underlies everything we experience. Moreover, the entropy gap implied by the past hypothesis is a cosmic store of information and order that provided the raw material out of which all chemical, gravitational, biological, and other forms of order in our universe ultimately derive. But, Rovelli argues, it isn't necessary for the universe to have had a low-entropy state; it just needed to be low entropy *from a particular point of view*.

I don't really see how that can work. Although one could identify subsystems with respect to which the universe appears low entropy, I can't see how it would continue to be low entropy despite the progression of time either forward or backward. I'm not sure that Rovelli really sees how it works, either—he as much as admits that it is a desperate measure to avoid the past hypothesis. But there may be a core of an idea here that could be made to work, perhaps with additional ingredients, such as cosmological inflation.

Those scientific issues, however, should not detract from what is so delightful about this book. It is infused with wisdom, warmth, and intelligence. A reader looking for a more detailed understanding of issues of time in physics would do well with a weightier work like Sean Carroll's excellent *From Eternity to Here: The Quest for the Ultimate Theory of Time* (2010). But although low in mass, Rovelli's book is heavy with insight and will give all readers a taste of the mysteries of time. It will lead nearly any reader to consider many things in a new light.

Anthony Aguirre

University of California, Santa Cruz

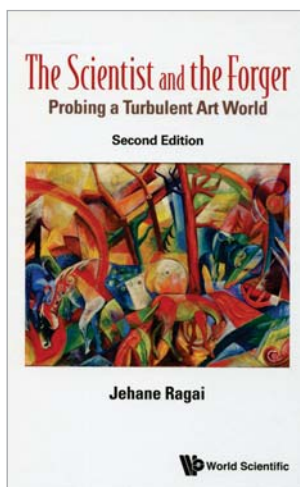
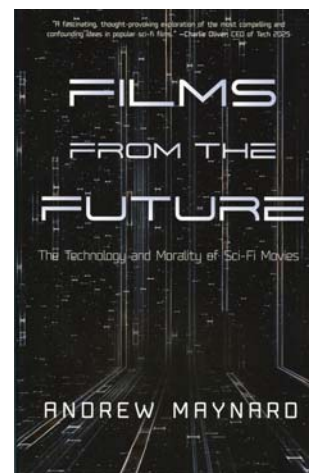
NEW BOOKS & MEDIA

Films from the Future

The Technology and Morality of Sci-Fi Movies

Andrew Maynard
Mango, 2018. \$27.99

From resurrection biology and human cloning to artificial intelligence and genetic manipulation, imagined technologies form the backbone of science fiction. In *Films from the Future*, physicist Andrew Maynard discusses the promises and potential pitfalls of technologies from 12 of his favorite movies—some blockbusters, like *Jurassic Park* (1993), and some more obscure, like *The Man in the White Suit* (1951). Part cautionary tale, part message of hope, Maynard's narrative is both entertaining and thought-provoking. —CC



The Scientist and the Forger

Probing a Turbulent Art World

Jehane Ragai
World Scientific, 2018 (2nd ed.). \$68.00

Jehane Ragai, an emeritus professor of chemistry at the American University in Cairo, Egypt, takes the reader on a tour through the fascinating world of art forgery in the second edition of *The Scientist and the Forger*. Ragai covers the science of forgery detection but also emphasizes other signs that a piece of art might be fraudulent, such as the lack of a paper trail establishing ownership. The chapters string together anecdotes about different forgers and forgeries in a way that can sometimes feel disjointed, but readers interested in art will find much to intrigue them. The book's beautiful color images add another level of appeal. —MB

King of the Dinosaur Hunters

The Life of John Bell Hatcher and the Discoveries That Shaped Paleontology

Lowell Dings
Pegasus Books, 2018. \$35.00

John Bell Hatcher was a prolific 19th-century collector of prehistoric fossils and bones, including the first *Triceratops* skeleton. In *King of the Dinosaur Hunters*, paleontologist Lowell Dings concentrates on Hatcher's professional life. He delves into Hatcher's extensive travels, fossil collecting, and all the minutiae associated with those activities, including letters to employers, expenses, and conflicts with his fellow paleontologists. The book provides little detail about Hatcher's personal life and is aimed primarily at paleontology devotees interested in knowing more about the challenges of early fossil hunting. —CC



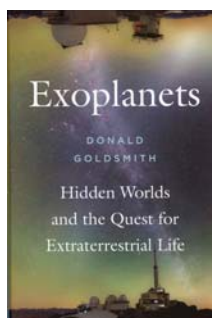
Exoplanets

Hidden Worlds and the Quest for Extraterrestrial Life

Donald Goldsmith

Harvard U. Press, 2018. \$24.95

Astronomer Donald Goldsmith considers the past and future of exoplanet science in his new book, which is aimed at a scientifically informed but nonexpert audience. He recounts early efforts to detect planets outside our solar system and explains the breakthroughs in detection methods that enabled astronomers to find the first exoplanets. He also gives an informative account of where known exoplanets are and what they might be like, along with a tantalizing glimpse at what might come next for astronomers as they search beyond the solar system's bounds. —MB



The Sun

One Thousand Years of Scientific Imagery

Katy Barrett and Harry Cliff

Scala, 2018. \$27.95

Created to accompany a special exhibition at London's Science Museum, *The Sun* highlights sketches, paintings, and photographs from the museum's solar imagery collections. Illustrations

range from a 12th-century monk's sunspot drawings in an illuminated manuscript, to an 18th-century Spirograph-like representation of the solar system, to photographic close-ups of the Sun taken by orbiting spacecrafts. Authors Katy Barrett and Harry Cliff, both curators at the museum, showcase the creativity of astronomers, theologians, and artists over the past millennium. —CC

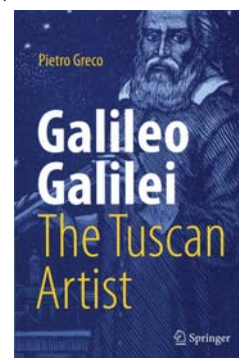
Galileo Galilei

The Tuscan Artist

Pietro Greco

Springer, 2018. \$44.99

In this full-length biography, science writer Pietro Greco delves into the life and times of the celebrated Italian polymath and Renaissance man Galileo Galilei. Although "artist" may not be the first word that comes to the reader's mind regarding Galileo, the book's subtitle is actually a quote from *Paradise Lost*, in which John Milton refers to his famous contemporary. Milton's words acknowledged that Galileo excelled not only in science but also in philosophy, theology, and the arts. Drawing on an extensive bibliography and filled with digressions and trivia, this 383-page book aims to be an in-depth portrait of a man Greco calls "a real superstar, probably the first big star of the modern age." —CC



ADHESIVE ACADEMY

HIGH VISCOSITY SYSTEMS

This educational video explains the benefits of utilizing high viscosity and non-drip adhesive formulations for bonding vertical substrates and gap filling.

NON-DRIP

GAP FILLING

Are high viscosity adhesives right for your application?

MASTERBOND®
ADHESIVES | SEALANTS | COATINGS

Hackensack, NJ 07601 USA • +1.201.343.8983 • main@masterbond.com

www.masterbond.com

New Physics textbooks

from Oxford University Press

AN INTRODUCTION TO ELECTRODYNAMICS

Concepts of Elementary Particle Physics

ELECTROMAGNETIC RADIATION

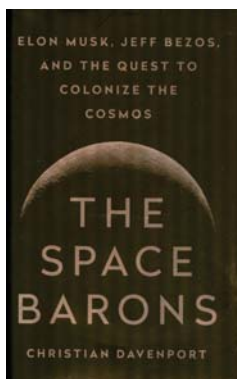
An Introduction to Quantum Optics and Quantum Fluctuations

Browse the full range of graduate textbooks in Physics and request inspection copies at www.oup.com/academic/physics

OXFORD
UNIVERSITY PRESS

The Space Barons

Elon Musk, Jeff Bezos, and the Quest to Colonize the Cosmos



Christian Davenport
PublicAffairs, 2018. \$28.00

Christian Davenport, a journalist for the *Washington Post*, dives into the world of private space-flight in this new volume. *The Space Barons* focuses on

billionaires Jeff Bezos and Elon Musk, each of whom has invested part of his personal fortune in the future of commercial space travel. Davenport tells an entertaining story of the rivalry between Bezos's Blue Origin and Musk's SpaceX and provides readable short biographies of both men. Quotes from interviews with Bezos, Musk, and other major players in the spaceflight industry are particularly illuminating.

—MB

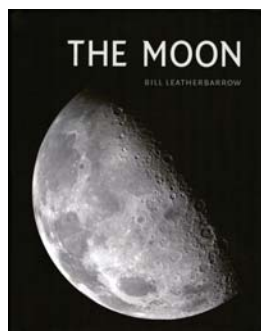
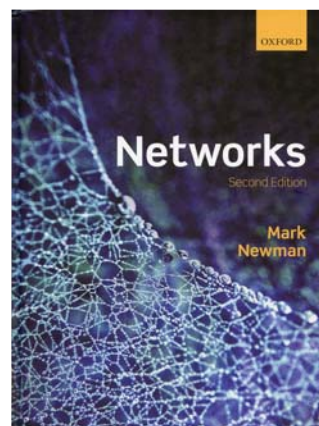
Networks

Mark Newman

Oxford U. Press, 2018 (2nd ed.). \$65.00

University of Michigan physicist Mark Newman first published his textbook *Networks* in 2010, but as he says in the introduction to the second edition, the science of networks is moving quickly. The new and updated *Networks* adds sections on topics including multilayer networks, complex contagion, and network synchronization. It also includes updates to other sections of the book and new exercises for students. Newman aims the first 10 chapters at students in a general-knowledge course on networks; later chapters will require knowledge of linear algebra and more.

—MB



The Moon

Bill Leatherbarrow

Reaktion Books, 2018. \$40.00

The Moon has fascinated humans since ancient times. In this brief history of lunar science, amateur astronomer Bill Leatherbarrow discusses how human understanding and knowledge of the Moon has progressed from the earliest observations with the naked eye to an increasingly more sophisticated understanding with the invention of the telescope and the advent of space travel. Nicely illustrated with drawings, maps, and photographs, the book

ends with a chapter extolling the virtues of backyard astronomy and detailing the necessary equipment, the lunar features to look for, and the benefits of citizen science.

—CC PT

Mass spectrometers for vacuum, gas, plasma and surface science

HIDEN
ANALYTICAL

Instruments for Advanced Science

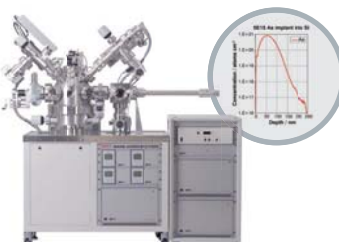
Residual Gas Analysis

- ▶ RGA at UHV/XHV
- ▶ High pressure RGA
- ▶ Molecular beams
- ▶ High mass RGA
- ▶ Temperature programmed desorption
- ▶ Electron/photon stimulated desorption



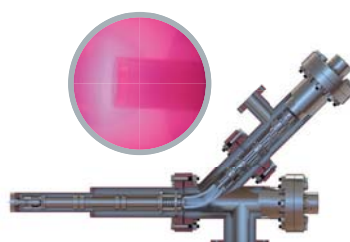
Thin Film Surface Analysis

- ▶ Static and dynamic SIMS
- ▶ Chemical composition & depth profiling
- ▶ SIMS for FIB including bolt-on modules & integrated SIMS-on-a-Flange
- ▶ Choice of primary ions
- ▶ Complete SIMS workstations



Plasma Characterisation

- ▶ EQP ion mass and energy analyser
- ▶ RF, DC, ECR and pulsed plasma
- ▶ Neutrals and neutral radicals
- ▶ Time resolved analysis
- ▶ HPR-60 extends analyses to atmospheric pressure processes



W www.HidenAnalytical.com

E info@hiden.co.uk