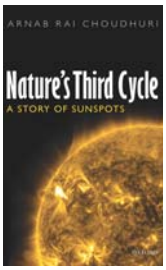
Choudhuri's captivating narrative starts with the massive power blackout of 13 March 1989 in Quebec, an event caused by a strong solar flare from a few days earlier. Such strong solar eruptions are associated with sunspots, clusters of which form active regions with topologically complicated magnetic field structures.

The author details such historical highlights as the discovery of the 11-year solar cycle and makes a brief excursion into the solar interior's dynamics and evolution. His simple description of a turbulent plasma in a magnetic field serves as an introduction to the deep theoretical studies of magnetic field generation and to Eugene Parker, Horace Babcock, and Robert Leighton, the scientists who developed the foundation of solar dynamo theory.



The long record of solar observations shows that the duration and strength of solar cycles have varied over time. Our understanding of the solar cycle is determined by the ability of theoretical models to make reliable forecasts, and until recently, available models failed to correctly predict either a cycle's amplitude or the time of the next solar maximum. During the past 10 years, however, a new approach has emerged: Realizing that our knowledge of the Sun's interior is still incomplete, solar physicists are combining theoretical modeling with observational data.

Although Choudhuri does not detail the new "data assimilation" approach in the book, he has previously suggested a weather forecasting scheme that combines observational data with a type of Babcock–Leighton mean-field dynamo model. Because of the known correlation between the strength of global magnetic fields during a solar minimum and during the next solar maximum, the magnetic field forecast is updated once per solar cycle, at the solar minimum, by means of an empirically determined dipole magnetic index. The assimilation of that data with the dynamo model enabled physicists to correctly predict the observed amplitude of the current solar cycle, which began in 2008 and is the 24th since extensive recording of sunspot activity began in 1755.

Nature's Third Cycle includes approaches to model the solar cycles and their predictions using rigorous mathematical methods that are briefly described in the appendices. The next step is to incorporate nonlinear magnetohydrodynamic models and data assimilation; the new prediction models that result may be considered as an ensemble of possible states sequentially adjusted with observational data. In my recent work with Alexander Kosovichev, we have applied that approach to describe the observed asymmetry of solar cycles, which grow faster than they decay (the so-called Waldmeier effect). Our initial results are in good agreement with the actual observed evolution of the current solar cycle—the good agreement suggests the possibility of making reliable predictions at least seven years forward after a solar minimum.

I strongly recommend *Nature's Third Cycle* to readers who are interested in learning about solar activity, its effects on Earth, and the history of the field. It includes technical details and references for delving deeper into a fascinating topic, yet it is easy and enjoyable to read.

Irina Kitiashvili
NASA's Ames Research Center
Moffett Field, California

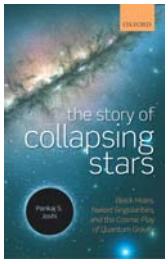
The Story of Collapsing Stars

Black Holes, Naked Singularities, and the Cosmic Play of Quantum Gravity

Pankaj S. Joshi

Oxford U. Press, 2015. $49.95 (225 pp.).
ISBN 978-0-19-968676-6

What happens to a star after it has exhausted its nuclear fuel? If the star's initial mass is sufficiently small, it collapses gravitationally and becomes a white dwarf or a neutron star. For massive stars, the inevitable final state is a singularity hidden behind an event horizon—that is, a black hole. At least that is the story told by the cosmic censorship conjecture, which does not permit "naked" singularities void of an event horizon as the end state of gravitational collapse. However, the conjecture is still unproven.



In *The Story of Collapsing Stars: Black Holes, Naked Singularities, and the Cosmic Play of Quantum Gravity*, Pankaj Joshi presents the active field of research on gravitational collapse. He concentrates on possible outcomes of such collapses, probing the conditions under which collapsing stars form black holes, which are not visible to a distant observer, and naked singularities, which can be seen by a distant observer. He also asks how we should formulate the cosmic censorship conjecture so that it can be proved. Joshi outlines his and others' efforts in the past few decades to address those research questions.

The book starts out with a short, accessible exposition of general relativity. Joshi then describes singularities; in particular, he discusses the singularity theorems, which state the conditions under which singularities form in general relativity. He details the two possible kinds of singularity—black holes and naked singularities. Unfortunately, he neglects to include a short overview of the astrophysical evidence for their existence, as Fulvio Melia did in *The Black Hole at the Center of Our Galaxy* (Princeton University Press, 2003).

In the subsequent chapters, Joshi presents different models for the gravitational collapse of massive stars. He starts with the idealized collapse of a spherical, symmetric, and homogeneous dust cloud, which unambiguously does lead to a black hole. After that, Joshi relaxes all the assumptions gradually and considers inhomogeneous dust models, different matter models, deviations from spherical symmetry, generalized theories of gravitation, and more. He shows that naked singularities are indeed a viable end state of the collapse of a star whose matter satisfies the standard energy conditions. Unfortunately, the assumptions made beyond the energy conditions—for example, for velocity and density profiles—are not justified astrophysically, microphysically, or otherwise. Thus it might be difficult for readers to evaluate the applicability of the models to realistic collapse scenarios. Additionally, a reference list would have been helpful for expert readers.

Chapter 7, "Cosmic Conundrums," is a highlight of the book. Therein, Joshi brings together the material of the previ-

ous chapters by formulating common questions regarding the cosmic censorship conjecture and additional properties of black holes and naked singularities. He answers those questions directly based on current knowledge and does not shy away from pointing out open issues. For scientists who are interested in studying gravitational collapse, this section will be valuable.

The book concludes with a discussion of the observational signatures of naked singularities and how those objects can be distinguished from black holes. And it discusses possible observations of quantum gravity effects. The extreme conditions near a naked singularity allow processes at such high energies that we might indeed be able to see evidence for a unification of quantum mechanics and general relativity. That would make naked singularities—if they are observed—an exciting laboratory for the discovery of new physics.

Although meant for a popular audience, *The Story of Collapsing Stars* presents the open research questions so clearly that it can also serve as a valuable starting point for scientists and students considering research in the area of gravitational collapse.

Norman Gürlebeck
University of Bremen
Bremen, Germany

NEW BOOKS

Acoustics

Acoustic Modeling for Emotion Recognition. K. R. Anne, S. Kuchibhotla, H. D. Vankayalapati. Springer, 2015. $54.99 *paper* (66 pp.). ISBN 978-3-319-15529-6

Battlefield Acoustics. T. Damarla. Springer, 2015. $94.99 (262 pp.). ISBN 978-3-319-16035-1

Astronomy and astrophysics

Black Holes: Thermodynamics, Information, and Firewalls. R. B. Mann. Springer, 2015. $54.99 *paper* (97 pp.). ISBN 978-3-319-14495-5

Library and Information Services in Astronomy VII: Open Science at the Frontiers of Librarianship. A. Holl, S. Lesteven, D. Dietrich, A. Gasperini, eds. Astronomical Society of the Pacific, 2015. $77.00 (347 pp.). ISBN 978-1-58381-868-8

Physics of Magnetic Flux Tubes. M. Ryutova. Springer, 2015. $179.00 (559 pp.). ISBN 978-3-662-45242-4

Shakespeare and Saturn: Accounting for Appearences. P. D. Usher. Peter Lang, 2015. $86.95 (243 pp.). ISBN 978-1-4331-2860-8

Biological and medical physics

VI Latin American Congress on Biomedical Engineering CLAIB 2014, Paraná, Argentina, 29, 30 & 31 October 2014. A. Braidot, A. Hadad, eds. Springer, 2015. $259.00 *paper* (1023 pp.). ISBN 978-3-319-13116-0

Cancer Nanotheranostics. P. Gopinath et al. Springer, 2015. $54.99 *paper* (119 pp.). ISBN 978-981-287-434-4

Computational Hemodynamics—Theory, Modelling and Applications. J. Tu, K. Inthavong, K. K. L. Wong. Springer, 2015. $179.00 (351 pp.). ISBN 978-94-017-9593-7

Intensity-Modulated Radiation Therapy: Clinical Evidence and Techniques. Y. Nishimura, R. Komaki, eds. Springer, 2015. $249.00 (473 pp.). ISBN 978-4-431-55485-1

New Techniques in Systems Neuroscience. A. D. Douglass, ed. Springer, 2015. $129.00 (301 pp.). ISBN 978-3-319-12912-9

Quantum Adaptivity in Biology: From Genetics to Cognition. M. Asano et al. Springer, 2015. $159.00 (173 pp.). ISBN 978-94-017-9818-1

Scientific Basis of the Royal College of Radiologists Fellowship: Illustrated Questions and Answers. M. Sperrin, J. Winder. IOP, 2014. $190.00 (250 pp.). ISBN 978-0-7503-1059-8

Chemical physics

Advanced Time-Correlated Single Photon Counting Applications. W. Becker, ed. Springer, 2015. $229.00 (624 pp.). ISBN 978-3-319-14928-8

Annual Review of Physical Chemistry. Vol. 66. M. A. Johnson, T. J. Martínez, J. T. Groves, eds. Annual Reviews, 2015. $99.00 (754 pp.). ISBN 978-0-8243-1066-0

Characterization of Zeolite-Based Coatings for Adsorption Heat Pumps. A. Freni et al. Springer, 2015. $54.99 *paper* (96 pp.). ISBN 978-3-319-09326-0

Colloid Process Engineering. M. Kind, W. Peukert, H. Rehage, H. P. Schuchmann, eds. Springer, 2015. $119.00 (398 pp.). ISBN 978-3-319-15128-1

Lanthanide Single Molecule Magnets. J. Tang, P. Zhang. Springer, 2015. $99.00 (211 pp.). ISBN 978-3-662-46998-9

Spectra and Dynamics of Small Molecules: Alexander von Humboldt Lectures. R. W. Field. Springer, 2015. $49.99 *paper* (153 pp.). ISBN 978-3-319-15957-7

Supramolecular Polymer Networks and Gels. S. Seiffert, ed. Springer, 2015. $259.00 (288 pp.). ISBN 978-3-319-15403-9

Computers and computational physics

High Performance Computing in Science and Engineering '14. W. E. Nagel. D. H. Kröner, M. M. Resch, eds. Springer, 2015. $189.00 (691 pp.). ISBN 978-3-319-10809-4

Condensed-matter physics

Superconductivity: Basics and Applications to Magnets. R. G. Sharma. Springer, 2015. $179.00 (414 pp.). ISBN 978-3-319-13712-4