

Storm in a Teacup: The Physics of Everyday Life

Brad Halfpap

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Your Guide to the 2017 Total Solar Eclipse

Michael E. Bakich

Springer, 2016. \$34.99 paper (395 pp.). ISBN 978-3-319-27630-4



The path of totality for the Great American Eclipse of 21 August 2017 will sweep majestically from sea to shining sea, span almost 5000 km, and have a width of about 115 km. Landfall is on the Pacific coast west of Salem, Oregon; from there, the Moon's shadow will cross 14 states at speeds of up to 1.0 km/s before departing the continental US north-east of Charleston, South Carolina.

This eclipse, the first one visible from coast to coast since 1918, might well prove to be the most viewed sky event in history, with observers numbering in the millions. Hotels along the center line, where observers will see the entire Sun obscured, have been fully booked for years. Maximum totality will be in the vicinity of Carbondale, Illinois, and will last just 2 minutes and 41.6 seconds. Carbondale is also the spot where the center lines of the 2017 eclipse and the 8 April 2024 eclipse intersect, making it the Eclipse Crossroads of America.

Outside the path of the Moon's shadow, the eclipse will be partial: Everyone in the continental US will see at least 48% of the Sun's surface obscured, which is great. However, a total eclipse is about totality! To experience the wonder of the corona, the chromosphere, the diamond-ring effect, and maybe prominences too, you must be in the path of totality. Being close simply isn't good enough.

Michael Bakich's new book, *Your Guide to the 2017 Total Solar Eclipse*, is all about being fully prepared, whether you're a dedicated eclipse chaser or a first-timer. With great clarity, the first six chapters introduce important concepts for curious members of the public who may never have witnessed a total eclipse. The illustrated glossary and frequently asked questions are an accessible guide to the basics: Is the eclipse safe to view, and what equipment is needed?

However, I found that chapter 5 on the Saros cycle of eclipse recurrences introduced unnecessary complexity too soon for the average Sun watcher. I rec-

ommend skipping it. Chapter 6, in contrast, inspires with a well-researched narrative on historical solar eclipses. It includes an enjoyable short account of Arthur Eddington's expedition to observe the eclipse of 1919. His trip provided the photographic evidence for the deflection of light by the Sun's gravitational field, predicted in 1915 by Albert Einstein.

From that historical launch, chapters 7–12 cover every aspect of observing an eclipse with the unaided eye. They offer vital safety advice, tips on how not to observe, and guidance on what you can see. Bakich, a senior editor at *Astronomy* magazine and a veteran of 13 total eclipses, provides a handy diagram of what the sky will look like during totality. Venus, Arcturus, and Sirius will be easy to spot, but don't waste your precious seconds finding fainter objects. Above all, do not attempt to photograph your first eclipse because you will miss experiencing one of nature's greatest spectacles.

Storm in a Teacup The Physics of Everyday Life

Helen Czerski

W. W. Norton, 2016. \$26.95 (288 pp.). ISBN 978-0-393-24896-8

Books written to show nonphysicists the world as a physicist sees it have a long history. In 1939 George Gamow published *Mr Tompkins in Wonderland*, which described how the world would look were the universal constants to take on very different values—for example, if the speed of light were 10 m/s. Between 1980 and 1986, James Trefil wrote six books with titles like *A Scientist at the Seashore*, in which commonly observed phenomena were carefully described and then qualitatively analyzed. Brian Greene explored cosmology in his 2005 *The Fabric of the Cosmos*. All three of these authors tell a story both correctly

and well, in a manner that is compelling to the untrained reader. I am delighted to add Helen Czerski, author of the new book *Storm in a Teacup: The Physics of Everyday Life*, to that distinguished company.

Authors write best about what they know well. Czerski is a physicist at University College London who studies the behavior of bubbles and films of bubbles; her expertise is in phenomena at the human scale as opposed to those of elementary particles or galactic clusters. Each of her nine chapters tells a story with a rich and varied cast of people,

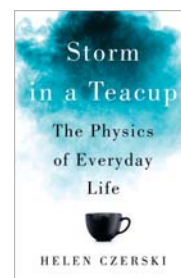
Chapters 13–18 concern different types of equipment—binoculars, telescopes, cameras (for experienced eclipse chasers), and filters—and how to use them. A notable strength of the book is the extensive information on specific products that can be purchased for making serious observations of the Sun. The consumer information on telescopes and their accessories is particularly helpful. Next up, for those ready to make the trek, is advice on getting to the center line, including checklists of what to take (cash, sunscreen, toilet paper, and so forth), weather data, and suggestions of 20 prime spots for viewing the eclipse.

Twelve appendices conclude the book. They include many helpful lists of eclipse facts and a self-indulgent 22 pages of the author's collection of eclipse postage stamps. Throughout, the guide is enriched by more than 100 photographs, a great many of them by the author or his wife, Holley Bakich, and a gold mine of explanatory diagrams from *Astronomy* magazine.

Overall, *Your Guide to the 2017 Solar Eclipse* is an inspiring practical handbook to this month's exciting event, and much of the advice will be valid for the repeat performance in 2024. Astronomy is looking up: Enjoy the eclipse!

Simon Mitton

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Authors write best about what they know well. Czerski is a physicist at University College London who studies the behavior of bubbles and films of bubbles; her expertise is in phenomena at the human scale as opposed to those of elementary particles or galactic clusters. Each of her nine chapters tells a story with a rich and varied cast of people,

objects, ideas, and events. We encounter trees and towels, ketchup and snails, blown glass and duck feet, and human beings. How do the inhabitants of her chapters behave? How are they the same? How can we come to understand them? Replete with historical detail, the writing makes us care about what Czerski's dramatis personae will do, why they will do it, and what will result.

In chapter 3, for example, we are introduced to water and some of its wonderful properties through a careful consideration of a coffee stain on a tabletop. After two pages, we have seen how coffee particles are moved about by evaporating water molecules, and we are ready and eager to learn why milk doesn't separate. So we turn the page to read about milk and what we see is this:

Before you can worry about things that are too small to see, you have to know that they're there. Humanity faced a catch-22 here—if you don't know there's anything there, why would you go looking for it? But all of that changed in 1665 with the publication of one book, the first scientific bestseller: Robert Hooke's *Micrographia*.

Then follow two delightful pages of scientific history centered on Hooke's newly developed microscope. The historical exploration allows Czerski to elegantly segue between the force that dominated chapters 1 and 2, gravity, and the force needed for her current story, surface tension.

So, on to the story of milk and cream—but not so fast. There is time for a description of the foil-covered English milk bottles that were once delivered to door steps in the early morning and the English blue tits that learned to fly to the bottles, peck holes in the foil, and drink from the cream that floated on the top. Now we can look at how fat globules move through water at a rate that depends on their size and learn why homogenized milk has fat globules with just one-fifth the radius of those in ordinary pasteurized milk. The cream in homogenized milk rises so slowly that we see no sign of it, and the blue tits must look elsewhere for their breakfast.

In the rest of chapter 3, we meet Egyptian mummies with consumption and learn about the physics of bubble baths, 2.8-mile ocean swims, and towels.

Finally, we arrive at a grove of California redwoods, which Czerski describes with poetic flair: "The forest is quiet and humid. It feels as though it must always have been like this, as though change is rare here . . . there's a looming patch of darkness in the forest, something that doesn't fit. . . . It's a thousand-year-old colossus lurking among the youngsters, stamping its status on the forest with its shadow."

Then we learn how the scientific principles explained earlier in the chapter dictate the trees' needle size and how the structure of the needles and the properties of water limit the height of trees. Finally, we travel across the US to Harvard University where blood chemistry laboratories are being developed on paper the size of a postage stamp. That blood test technology relies on the same principles that dictate the trees' size, and it may

save millions of lives across the world.

There is real science in Czerski's stories, and it's described in a serious manner. But what I love about the book is that it is always clear that science is a human-centered activity performed by people. Science tells stories for everyone, not just a small community of geeks.

As should be apparent, I think *Storm in a Teacup* will entertain and educate any person with a healthy curiosity about the natural world. I have only one complaint to register, and that is the complete lack of pictures and illustrations. In a hundred places images would enrich the story and delight the reader. But that objection pales in comparison to what Czerski has written. Encourage her to write more; buy this book.

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Maxwell's Enduring Legacy A Scientific History of the Cavendish Laboratory

Malcolm Longair

Cambridge U. Press, 2016. \$69.99 (650 pp.). ISBN 978-1-107-08369-1



In 1874 Cambridge University created a department of physics—the Cavendish Laboratory—in response to concerns that the UK was lagging behind the European continent in the physical sciences. James Clerk Maxwell was the lab's first head. In *Maxwell's Enduring Legacy: A Scientific History of the Cavendish Laboratory*, astrophysicist Malcolm Longair offers a scientific history of the lab, from its foundation to the present. The illustrious nature of that history is evident from the names of the first few people who succeeded Maxwell: Lord Rayleigh, J. J. Thomson, Ernest Rutherford, and William Lawrence Bragg.

Longair is well qualified to tell this story. He earned his PhD at the Cavendish in 1967, was named Jacksonian Professor of Natural Philosophy there in 1991, and served as its head from 1997 to 2005. He says his "principal interest is in the *content* of the physics and how it came about, rather than a history of the personalities, politics, administrative structures, and so on." That is Longair's way of distinguishing his book from previous histories. *A History of the Cavendish Laboratory, 1871–1910* (Long-

mans, Green, and Co), published in

1910, featured firsthand accounts by nine of the lab's principal scientists. In 1974 the Cavendish celebrated its centennial and commissioned science journalist James Crowther to write *The Cavendish Laboratory, 1874–1974* (Macmillan). Crowther focuses mostly on the administration and politics of the lab and the personalities of those who worked there. A few lines of prose (and no equations) suffice for each highlighted scientific result.

Longair makes good use of that previous work and the memoirs and obituaries that have been published since 1974. His graceful account gives plenty of information about the personalities and politics, but, as promised, it is his treatment of the science that distinguishes his book from its predecessors. For example, an introductory chapter on 19th-century physics carefully outlines William Thomson's 1855 theory of the telegraph cable. Longair's in-depth discussion of Thomson's work is typical of what you'll find throughout the book; five pages of text, including nine equations and a diagram from Thomson's