

public figure? Working in the long tradition of unauthorized biographers, Seife relies on a series of less-than-charitable sources, including British tabloids, Hawking's first wife, betrayed grad students, and even Hawking's ex-literary agent, Al Zuckerman, who recounts being "stunned" by his firing in 2015. (Hawking wanted more money.)

Seife uses those tidbits to reestablish Hawking as a man rather than a disembodied brain. The author depicts Hawking as a complicated human being with a chronic illness to be managed and human needs to be fed. Hawking's home life, which at one point included his wife, her lover, his future wife, and her husband, did not meet middle-class expectations. Later there were reports that he was abused by his second wife. When traveling, he routinely asked his hosts to

take him to strip clubs. It's all a little tawdry, but then, that's fame.

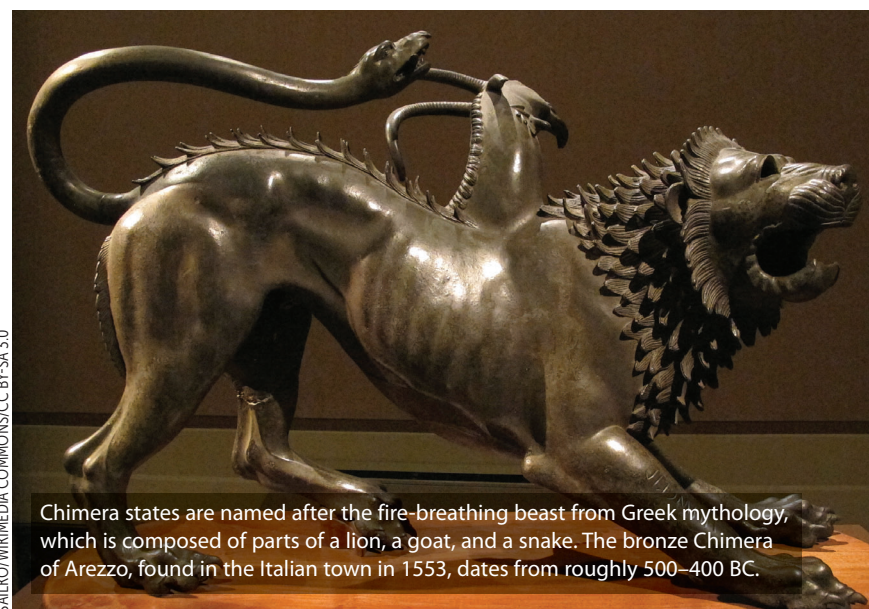
Hawking Hawking frequently returns to a theme previously explored in philosopher and anthropologist Hélène Mialet's *Hawking Incorporated: Stephen Hawking and the Anthropology of the Knowing Subject* (2012)—namely, the layers of infrastructure that made it possible for Hawking to become singularly famous despite his total dependence on other people. The fact that Hawking used a computer to vocalize his speech, for example, meant that his words could be produced, recorded, and circulated without his participation. During the making of Errol Morris's documentary film *A Brief History of Time* (1991), Hawking provided the director with a duplicate of his speech synthesizer. In 2015 his voice and image toured with the band U2.

For Mialet, the impossibility of sepa-

rating Hawking, the man, from "Hawking," the product, serves as a source of fascination and an example of how scientists' work is always embedded in their social worlds. For Seife, it's a symbol of Hawking's distance from mainstream scientific practices.

But Stephen Hawking was not a "collapsed star" or a "faint reflection of what he once had been," nor did he stop being a "real human being" when his health declined, as Seife asserts in the introduction. He was not a singularity. He was a cosmologist, a science popularizer, a media darling, and the world's most famous wheelchair user. Recognizing that he was all of that all at once should enrich rather than diminish our understanding of Hawking's life.

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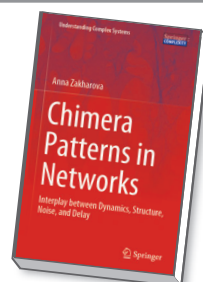


Chimera states are named after the fire-breathing beast from Greek mythology, which is composed of parts of a lion, a goat, and a snake. The bronze Chimera of Arezzo, found in the Italian town in 1553, dates from roughly 500–400 BC.

Chimera Patterns in Networks

Interplay between Dynamics, Structure, Noise, and Delay

Anna Zakharova
Springer, 2020. \$159.99



in a simple but head-scratchingly satisfying physical phenomenon.

Almost 20 years after Kuramoto and Battogtokh's initial discovery comes *Chimera Patterns in Networks: Interplay between Dynamics, Structure, Noise, and Delay* by Technical University of Berlin physicist Anna Zakharova. Her new book provides the nonlinear dynamics and complex systems communities with a comprehensive account of the rich dynamics exhibited by chimera states. It also elucidates the role that stochasticity, time delays, and network structures play in giving rise to the phenomenon. Zakharova is perfectly positioned to give such an account, as she has spent a decade researching self-organizing systems from both theoretical and experimental perspectives. Her work, much of which is mentioned in the book, has directly contributed to the community's current understanding of the dynamics of chimera states.

Chimera Patterns in Networks is primarily aimed at physicists, applied mathematicians, and engineers at the graduate level or beyond who are interested in chimeras and other synchronization

An overview of complex systems

In 2002 Yoshiki Kuramoto and Dorjsuren Battogtokh discovered a novel phenomenon when studying a ring of identical, nonlocally coupled phase oscillators: The oscillators formed spatially distinct but coexisting regions of synchronization and desynchronization. That counterintuitive dynamic state was subsequently generalized to describe any system in which an ensemble of identical elements self-organizes into coexisting coherent and incoherent regions. Daniel Abrams and Steven Stro-

gatz later named the phenomenon a "chimera state," after the hybrid beast from Greek mythology that's composed of parts of a lion, a goat, and a snake.

At that time, interest in complex systems was exploding, so chimera states quickly drew attention from the nonlinear dynamics community. Research into the states draws on principles from that field as well as those of complex networks, self-organization, stochasticity, and time delay. They embody complexity like few other topics and wrap it up

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BOOKS

patterns. Given the attention it pays to a blend of rich dynamics and practical considerations, the book will be particularly useful to those readers who are new to the study of complex systems that exhibit chimeras. They will appreciate how Zakharova includes a thorough discussion of topics that tend to puzzle researchers entering the world of chimeras, such as the choice and importance of parameters and initial conditions.

The book comprises four chapters, the first of which is an introduction that briefly summarizes existing literature on chimera-state research. Chapters 2 and 3 dive into amplitude chimeras and coherence-resonance chimeras, both of which are covered in the context of ring networks. Using rings as the narrative thread was a smart decision, because they both are historically important to the field and tend to be the best environment for intuitively visualizing the various important dynamic states. The book contains an especially cogent discussion of amplitude chimeras, which provide a perfect platform for exploring chimera death and in-

vestigating the effects of time delays and stochasticity. Control, on the other hand, is primarily discussed in the context of coherence-resonance chimeras.

The book closes with an exploration of novel synchronization patterns and chimera states in more general and realistic network topologies, both traditional and multiplex, rather than rings. Given her focus on limit-cycle oscillator systems, Zakharova does not discuss the analytical treatment of chimera states. Readers interested in analytical methods and the intuition they provide will thus have to go directly to the literature.

Chimera Patterns in Networks aims to highlight the richest possible dynamics exhibited by chimeras and link them to themes at the forefront of complexity—namely, stochasticity, time delay, and network structure. Zakharova is overwhelmingly successful in doing so, and the result is a text that is both practical and inspirational.

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NEW BOOKS & MEDIA

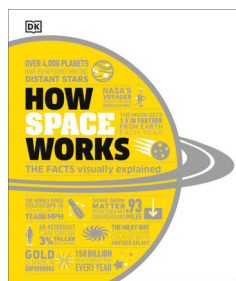
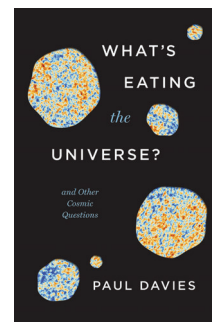
What's Eating the Universe? And Other Cosmic Questions

Paul Davies

U. Chicago Press, 2021. \$22.50

Understanding theoretical physics is a daunting task, but cosmologist Paul Davies's new book *What's Eating the Universe?* is here to guide readers through the field. Davies covers general relativity, antimatter, time travel, the multiverse, and just about any other topic he could fit into the book's 200 pages. Each chapter is short—less than 10 pages—but jargon-free and full of information. Davies uses a conversational tone to draw the reader in as he skims the history, experiments, and significance of each concept. Regardless of the reader's prior physics knowledge, the book provides an accessible introduction to cosmology.

—MRB



How Space Works

The Facts Visually Explained

DK, 2021. \$22.00

How big is the universe? What preceded the Big Bang? Why do stars appear to move across the night sky? Those are just some of the questions addressed by *How Space Works*, an introductory reference book aimed at beginning astronomers, ages 12 and up. Featuring colorful graphics and brief, nontechnical text, the book starts off

with a discussion of space from the vantage point of Earth before moving on to explore the solar system, stars, galaxies, and the universe. Among the many topics the book touches on are dark matter, star formation, cosmic rays, and even the search for alien life. The seven-page index should help readers navigate the book's encyclopedic format.

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