How Do You Find an Exoplanet? FREE

Samantha J. Thompson

Physics Today **69** (11), 59–60 (2016);
https://doi.org/10.1063/PT.3.3369

molecular resonances; and excited, compound nuclei.

Two chapters near the end of the book reflect Schieck's research passion: They introduce the reader to the first experiments to use polarized beams with particular reaction systems. The final chapter discusses the discovery and our present understanding of giant resonances in nuclei. I would have liked to see some sentences about pigmy resonances, collective vibrations found in neutron-rich nuclei at energies too low for giant resonances.

In the end, Schieck delivers a delightful book appropriate for the reader seeking a first acquaintance with the subject. He is a highly reputable nuclear physicist and well experienced with public lectures and review articles. No wonder that he was able to describe a broad field of physics with so few words and so few equations.

Carlos Bertulani
Texas A&M University–Commerce

How Do You Find an Exoplanet?

John Asher Johnson
Princeton U. Press, 2016. $35.00 (178 pp.).
ISBN 978-0-691-15681-1

In *How Do You Find an Exoplanet?* John Asher Johnson explains the four key methods that have been used to discover exoplanets—planets that orbit around stars other than the Sun. Those are the radial velocity method, observations of transits, analysis of gravitational microlensing, and direct imaging. As Johnson states in his preface, many books explore the subject matter in much greater depth and complexity. His aim, however, is to make it accessible to anyone with an understanding of freshman physics. In that aim he succeeds. Readers with an understanding of Kepler's laws or even just Newtonian gravity will find the topics covered to be comprehensible and the progression of topics easy to follow.

The book starts with a short description of how Johnson first became interested in astronomy and, in particular, how he "discovered" his first planet—Jupiter—shining like a bright star in the night sky. The story helps readers identify with the author and points out that even those who grew up in a city with hardly any awareness of the nighttime stars above could be bitten by the astronomy bug. The introduction then gives a brief history of astronomy that includes a concise overview of the Copernican revolution. Even if the historical material is familiar to many readers, Johnson's perspective serves to illustrate how scientific ideas and discoveries progress and, in particular, how they can challenge our perceptions of our place in the universe. The introduction is also a good review for readers who need a brief refresher on the basics of Kepler's laws.

Johnson writes in a familiar tone and includes anecdotes from his own career as a professional astronomer on the hunt for exoplanets. At times, I could imagine myself in one of Johnson's classes, listening as he explains in his conversational style the theory behind the exoplanet discovery techniques and points to his whiteboard sketches to illustrate the basic concepts. That said, I should clarify that the diagrams in the book are by no means straight off a whiteboard. Rather, they are mostly clear, simple, well-labelled line diagrams.

I particularly like how Johnson starts from basic principles and explains jargon terms; he even includes a glossary at the back of the book in case readers forget. Reading a book that actually starts with simple approximations is a refreshing change. Once the general concept is clear and examples are given to provide approximate numerical values of observables, Johnson adds to the foundation by introducing terms such as eccentricity and angles of inclination to better describe real-life systems.

The ordering of the chapters and the number of pages dedicated to each discovery method approximate the order of how successful the technique has been in finding exoplanets. Currently, microlensing and direct imaging are competing for third place, although I expect direct imaging to become the dominant discovery method as scientists overcome the technological hurdles. And that brings me to my only quibble with the book: I would have liked a few more pages spent on direct imaging. That method had the fewest pages

dedicated to it and, as a consequence, the discussion of it felt overly concise. For example, Johnson does not mention the giant telescopes expected to come on line in the next 10 years. A discussion of those telescopes, whose primary mirrors have diameters of 20–40 m, would not only be an inspiring glimpse into future endeavors, it would also be a relevant addition to the description of the resolution and sensitivity required to directly image exoplanets.

From its cover, you may not immediately realize what *How Do You Find an Exoplanet?* is about. You'll find no depictions of imagined far-off star systems and alien-looking worlds, as is common for books on exoplanets. The paper is not glossy and the text and diagrams are black and white. The minimalist styling works in the book's favor; no distractions or superfluous images divert readers' attention from the important key concepts. I will certainly recommend the book to students interested in understanding exoplanet discovery.

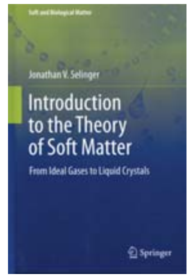
Samantha J. Thompson
University of Cambridge
UK

Introduction to the Theory of Soft Matter

From Ideal Gases to Liquid Crystals

Jonathan V. Selinger

Springer, 2016. $99.00 (185 pp.).
ISBN 978-3-319-21053-7



Increasingly interdisciplinary approaches in science and engineering require physicists to train students with nonphysics backgrounds to apply the methods and principles of physics to new research areas. That is a particularly challenging task with soft matter, a field that brings diverse disciplinary perspectives to bear on a broad class of materials and phenomena. Jonathan Selinger's new book, *Introduction to the Theory of Soft Matter: From Ideal Gases to Liquid Crystals*, presents students with many of the key methods and principles of condensed-matter theory that have been valuable for understanding and engineering soft matter, with a particular focus on the theory of liquid crystals.

Selinger, from the Liquid Crystal Institute at Kent State University, is an expert on the statistical physics of liquid-crystalline matter. His research ranges from the flexoelectric effect (a strain gradient inducing an electric polarization) to rubbery liquid-crystalline elastomers. This book has its roots in the lectures on soft matter he gives to first-year graduate students in chemical physics. Students enter that class from such diverse undergraduate backgrounds as physics, organic chemistry, materials science, and chemical engineering. According to Selinger, the aim of the book is twofold. First, it is an entry-level course for physics students going on to more advanced theoretical research. Second, it provides students without a physics background, and who will likely pursue experimental research in their graduate work, with a basic literacy in the terminology, concepts, and mathematical formalisms needed to engage with physical theories of liquid crystals and other soft matter.

The book is organized into 10 chapters and can be roughly grouped into two parts. The first covers introductory concepts and methods of statistical mechanics of condensed matter, including probability, entropy, order and symmetry, mean-field theory and phase transitions, and elementary field theory. The second part applies those concepts to selected topics in soft-matter physics, including phase transition dynamics and solids and glasses. The final chapter covers elements of liquid-crystal physics, from mesophase order and generalized elasticity to topological defects. Two "mathematical interludes" present essential elements of variational calculus and tensor manipulations for students who have not encountered those techniques in their undergraduate training.

Each chapter is built around one or two physical models—for example, the Ising model and van der Waals theory are used in the early chapters—with carefully presented derivations and discussions intended to demonstrate important principles. In most cases, key results are derived from multiple perspectives in order to emphasize both intuition and technical rigor. In comparison with other introductory texts on soft