by Dr T.L. Hughes on superconductors, the remainder from Dr B. Andrei Bernevig (assistant professor at Princeton University) evolved from lecture notes written in the period 2010–2011 for advanced graduate students. The topic of a 3-D topological insulator in a magnetic field is set aside in an appendix. Of the 84 references, only one is a textbook (M. Tinkham, *Introduction to Superconductivity*, 2nd ed., Dover Publications, 2004). This fact reveals something of the style of the book, which is very short on supplementary information that will assist a young researcher. Thus, while the topic of electrons in a steady magnetic field and Landau levels is a core topic there is no reference to the volume of Landau and Lifshitz *Course of Theoretic Physics* and the excellent account of it in the volume *Quantum Mechanics*. Nor is there mention of Onsager's seminal work in 1952 on quantisation that underpins the de Haas van Alphen effect.

Dr Bernevig's main topic is topological band theory, about which he writes well and with insight. Conventional Landau theory of phase transitions is formulated in terms of a local-order parameter, with observable consequences. But some states of matter with so-called topological order do not have a local-order parameter, e.g. fractional quantum Hall states with nonlocal-order parameter. Dr Bernevig writes with a beginning graduate student in mind, who wants to enter quickly the research on this field. A mix of physical insight with the rigorous computational details that would otherwise be time-consuming to derive from scratch is the stated goal. Topics covered in 17 chapters include, Berry phases, Chern numbers, Dirac fermions, Hall conductance and its link to topology, and the Hofstadter problem of lattice electrons in a magnetic field. Graphene is assigned a chapter of 20 pages. All chapters apart from the Introduction, Chapter 1, contain problems, with a total of 78 problems but no answers.

The hard-back review copy is of good quality, as expected from Princeton University Press. My well-thumbed copy of A.R. Edmonds, *Angular Momentum in Quantum Mechanics* (1960, Princeton University Press, Princeton) by A.R. Edmonds remains in good shape, and doubtless the review book will fair just as well with passage of time and use. A curious omission is that of the affiliations of the authors, Drs B. Andrei Bernevig and T.L. Hughes.

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Relativistic Hydrodynamics, by Luciano Rezzolla and Olindo Zanotti, Oxford, UK, Oxford University Press, 2013, 752 + 16 pp., £55.00 (hardback), ISBN 978-0-19-852890-6. Scope: monograph, text book. Level: postgraduate, advanced undergraduate, early career researcher, researcher.

Hydrodynamics is usually thought of as a 'classical' discipline in modern physics, but there are strong reasons for taking a relativistic approach, e.g., the equations of conservation of momentum and conservation of energy are actually different views of the same thing. Thus, this very important new monograph should have a much wider audience than merely cosmologists and astrophysicists. It is primarily directed at starting research students and more-established researchers, but much of the early material should be accessible by ambitious undergraduates.

Almost half of the book is devoted to an encyclopaedic review of the foundations of the subject, including classical and relativistic kinetic theory, relativistic perfect and non-perfect fluids, linear and nonlinear waves, and reaction fronts (detonations and deflagrations). The style achieves an altogether happy balance between abstract mathematical precision and a heuristic practical approach. Very little of this material is new, but it is highly advantageous to find it all in a unified notation in a single place.

The third quarter is devoted to an excellent review of modern numerical methods for solving the hydrodynamical equations, including high-resolution shock-capturing methods and high-order methods. Again, most of this is not new material, but the treatment is consistent and reflects the expertise of the authors in this subfield. There is a very useful appendix revealing some of the 'tricks of the trade' that professionals use in this area.

The final sections discuss some selected applications in astrophysics, distinguishing carefully between non-self-gravitating flows, hydrodynamics on a given gravitational background, and self-gravitating flows, where the gravitational field itself is evolving because of, and influencing, the fluid flow.

The authors have gone to considerable lengths to aid the tyro. The literary style is neither aloof nor patronising. The book is copiously illustrated, and most of the diagrams use colour informatively. Key equations are highlighted again using colour. Every chapter ends with suggestions for further reading, and with carefully selected exercises for the beginner. The depth of the treatment is exemplified by the fact that the bibliography runs to 38 pages and contains about 800 entries. The index too runs to 14 pages. Even those very familiar with the subject will find much material new to them here. Of course in an enterprise of this size, the first edition will inevitably contain a number of typographical and other errors. I did not detect any serious ones.

It is customary for book reviewers, myself included, to bemoan the high prices that publishers charge for specialist books. Here is a notable exception. Although £55 sounds high, the purchaser obtains a hard-backed book printed in colour on very high-quality (and very heavy) paper. But, it is for the unique content that I recommend this book unreservedly, to anyone who is interested in or wants to learn more about this fascinating topic.

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Graphene: A New Paradigm in Condensed Matter and Device Physics, by E.L. Wolf, Oxford, UK, Oxford University Press, 2013, 320 + 12 pp., £65.00 (hardback), ISBN 978-0-19-964586-2. Scope: monograph. Level: postgraduate, advanced undergraduate, early career researcher, researcher.

A chemist colleague has a jocular shorthand name for any moderately complex organic molecule: '2-5-dichloro-chickenwire'. In graphene we have pure carbon chickenwire, forming a material of extraordinary scientific and commercial interest, and this book provides a comprehensive review.

The opening chapter shows the range of phenomena that will be encountered in the book. This leads to a slightly disjointed effect: the anomalous quantum Hall effect is described here, whereas the quantum Hall effect is covered in Chapter 2 (Physics in two dimensions) and more details of the anomalous effects are given in Chapter 8. The treatment is, however, fully self-contained: for example, a chapter describing the basic principles of quantum chemistry, from atomic carbon through the hydrogen molecular ion, molecular hydrogen, methane, benzene and fullerene precedes the discussion of the band structure of graphene. Wherever possible theoretical passages are set against experimental results, using up-to-date material (papers from 2013 are included in the references), and there are clear descriptions of the experimental probes that are particularly useful.

There are detailed descriptions of the basic mechanical and electrical properties of graphene, with the latter including the effects of doping and the properties of bilayer graphene. The sources of graphene are reviewed, from the basic Scotch tape process to methods capable of producing films up to 30 inches long. There is close attention to practical issues throughout – for example, several pages are dedicated to a discussion of the stability of those 30 inch samples. More features of the electronic properties include the existence of electron and hole 'puddles', giant non-locality in transport, high-carrier mobility, Klein tunnelling and the graphene Josephson junction.

With such a range of phenomena to exploit, it is not surprising that the longest chapter addresses the applications of graphene. These include various forms of transistor, solar cells, spintronics and flash memory. It should be noted that, although popular press frequently trumpets graphene's extreme strength, its use in improving the mechanical properties of composites is not discussed here: the focus is on electronic applications involving high-quality material. The whole subject is coolly assessed against the balance between requirements in niche areas and the commercial upheaval associated with replacing silicon-based devices with ones using graphene.

The production of this book is to Oxford University Press's usual high standards, and the contents provide an excellent overview of the current fundamental understanding and potential exploitation of this astonishing material. It could be understood by an undergraduate in physics, and would be invaluable to an early stage researcher in the field.

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Phase Transitions: Modern Applications (2nd edition), by Moshe Gitterman, Singapore, World Scientific, 2013, 212 + 12 pp., £32.00 (hardback), ISBN 978-9-81-452060-7. Scope: text book. Level: postgraduate.

The literature of phase transitions is so vast that, before opening this volume, it was hard to see how it would be possible to add usefully to the subject in fewer than 200 pages: yet, somehow, it works. It is perhaps best to think of this as a tasting menu compiled by an expert with many years' experience: it will excite interest, make the reader think about the material and leave an appetite for more.

The most attractive feature of the book is the way it introduces simple models of complex processes in a way that illuminates the underlying physics. Some of the material is quite standard, but often with a slight twist. The Ising model plays a large part, but here the author