**Physics of Continuous Matter. Exotic and Everyday Phenomena in the Macroscopic World**, by B. Lautrup, Institute of Physics, Bristol, 2004, pp. xiv + 608, £29.99, paperback (ISBN 0 7503 0752 8). Scope: textbook. Level: undergraduate.

This is a very remarkable undergraduate-level text, covering the mathematical description of matter viewed as a continuum, both solid and fluid. The text is divided into five main sections. There is an introductory section of three chapters, consisting of derivation of the continuum approximation, a formal introduction to vectors and coordinate transformations, and an account of Newtonian gravity. This is followed by a section of five chapters on fluids at rest, which covers the hydrostatic equilibrium of floating bodies, such as ships and balloons, and self-gravitating bodies, such as planets and stars, an elementary account of the theory of tides, and surface tension. The next two sections cover elasticity and fluid mechanics respectively, and the final large section consists of special topics in fluid mechanics, which are treated in much greater detail. Every chapter concludes with a problem set, to which there is a complete set of solutions at the back of the book.

Its broad scope makes *Physics of Continuous Matter* a very unusual modern text: indeed it is strikingly unlike almost all the books in its bibliography, which typically cover elasticity, or fluid mechanics, or planetary physics or oceanography or some other subset of this material. But in fact these subjects do all mutually illuminate one another, because they can be treated within a single coherent conceptual framework, derived from the conservation of mass and Newtonian dynamics. Their fundamental equations are thus in every case the equation of continuity, and a dynamical equation in which the forces are given by the gradient of a stress field, so that there is much to be gained by studying all these subjects as a set. To obtain a closed set of equations one has to supply an equation giving the dependence of the stress on the other variables, and this is the only feature which really distinguishes the different sections. As befits an introductory text, Lautrup's choice here is usually the simplest possible: some form of barotropic equation giving the pressure as a function of the density. Of course this precludes discussion of many interesting phenomena, such as energy production in stars, and diabatic processes in the planetary atmospheres to name but two, but in a text of 600 pages it is pointless to complain of omissions!

There is one book in the bibliography with a comparably broad, if slightly different, scope, which is Newton's *Principia*, where, in Book III (*The System of the World*), Newton brings a large range of phenomena within a single explanatory scheme. Lautrup's subtitle is *Exotic and Everyday Phenomena in the Macroscopic World* and this is amply justified; the text is full of short Examples, in which the concepts under discussion are applied to a specific case with a short numerical calculation, and the range of these is striking, from insects walking on water, through chair legs and walking sticks, to the fluid instabilities of water jets and the figure of the Earth. Physicists are fond of claiming that their theories have to account for everything from the forces between the fundamental particles to the large-scale structure of the universe, but in fact these intermediate length scales are strikingly absent from many undergraduate courses, perhaps precisely because they are not modern physics. Lautrup does a great service in showing, in a modern text with contemporary examples and recent references, that the explanatory power of Newtonian physics is as great as it ever was, and the sense of having the keys to unlock the secrets of nature is still just as stimulating to the student.

One of the great merits of the text is the way that the fundamental physical equations are presented, with great clarity, so that when they are subsequently solved in some special case, or with some simplification, the starting point is still clear. Lautrup remarks, in his Preface, 'Physicists must learn to think in terms of fundamental principles and generic methods' and this does seem to have informed his treatment of the material. While this approach does cut out special methods of limited validity, which often give insight in particular cases, the gain in clear thinking and proper understanding more than makes up for any loss. He also rather engagingly remarks 'This book is written for adults with a serious intention to learn physics', and I think this too has informed his approach: there are no gimmicks, and few wasted words, but a great deal of very carefully organized material.

The equations being solved are notoriously difficult, in fluids because of their nonlinearity, and in elastic solids because of the geometrical complexity of the structures to which we wish to apply them. In each of these two cases there is a valuable chapter giving the outline of a numerical solution to a simple problem, with a discussion on the sort of difficulties which a numerical treatment of the equations throws up. While these do not refer explicitly to the standard programs used in these areas, they nonetheless prepare the student to ask sensible questions about them.

Of course there are points where I would have reservations about the text. Lautrup is a theoretician, and he clearly wishes the student to speak the language of mathematics with as much fluency as he does himself—which is surely the right approach. But sometimes a few extra words would help the novice to understand what the equation is saying. Thus, in Example 15.1.4 (to illustrate the differences, in a non-steady case, between the different lines used to visualize flows) a few words to the effect that the flow field given is that of the air in a lift in free-fall as seen from the surrounding building, or some equivalent case, would help to interpret the example. I found very few typographical errors, and Lautrup is maintaining an errata list on his web-site (www.nbi.dk/lautrup/continuum/index.html). This site also contains colour versions of some of the plots, which do indeed give a better visualization than the black-and-white of the published text.

I hope that many university physics courses will find room for something which can draw on *Physics of Continuous Matter*, and recover 'old-fashioned' Newtonian physics for the modern undergraduate curriculum. As Lautrup himself says: 'All physics students ought to be familiar with the description of the macroscopic world of apparently continuous matter'.

Dr C.W.P. Palmer
*University of Oxford, UK*

**Quantum-Classical Analogies, in the series The Frontier Collection**, by D. Dragoman and M. Dragoman, Springer, Berlin, 2004, pp. x + 344, £61.50, US$89.95, hardback (ISBN 3 540 20147 5). Scope: monograph. Level: specialist.

There is no doubt that the development of ideas in physics, as well as in many other sciences, has been enriched by the extraordinary elucidation that some familiar concepts in one area can be transferred to another one, and thereby gain new insights into either or both of them.

Analogies are a powerful cognitive tool that allow us to make inferences and learn new aspects from the comparison of two things by highlighting their similarities. In general, the reasoning behind this process involves the abstraction of details from a particular set of problems and the resolution of structural resemblance between previously distinct problems. In this book by Dragoman and Dragoman we are presented with an extensive number of analogies drawn between the two seemingly dissimilar worlds of classical and quantum physics. Many of these links are more than mere curiosities as it is patently shown in the book with the discussion of a number of recent developments in different areas of physics. The book is divided in 10 different chapters ranging from analogies between ballistic electrons and electromagnetic waves to analogies in phase space, passing through acoustics and particle optics.

Writing a book like this one is an arduous and ambitious task and as such it is hardly surprising that the final product is somewhat unbalanced in the depth in which the different subjects are treated or in the way the subjects are introduced. In many cases, for instance, the authors jump without warning from discussing a classical system in light of the quantum case to the opposite point of view, making it difficult for the reader to follow their arguments. It is important to mention that the book is intended to be a catalogue of phenomena shared between classical and quantum physics, rather than a textbook about them. Taking that into consideration, the reader must be aware that most sections contain mathematical statements about the subject under discussion, together with appropriate references. In some cases the mathematical formulation is of great help, specially if the reader has some experience in that particular area, however if the reader is new to the subject, it might be more difficult to grasp the full significance of the analogy. In such cases, the references given are an invaluable asset. Personally, I believe that the later chapters of the book accomplish much better the original aim of the authors.

Finally, as a warning for the interested reader, I would like to point out that the book does not discuss any philosophical or epistemological arguments about the quantum–classical correspondence principle. Similarly, the authors make it quite clear that they do not treat any classical–classical or quantum–quantum analogies and that they concentrate on analogies that imply formal similarities. This book is therefore a very good choice for those interested in bridging ideas from classical physics into the quantum world or vice versa, bearing in mind that only the shades are delineated here, the full picture will have to be sought elsewhere.

Dr J. Rogel-Salazar
*Imperial College London, UK*

**Quantum Field Theory of Many-body Systems**, by X.G. Wen, Oxford University Press, Oxford, 2004, pp. xiii + 505, £44.95, hardback (ISBN 0 19 853094 3). Scope: monograph. Level: specialist.

Prospective readers of this book should take careful notice of its subtitle *From the Origin of Sound to an Origin of Light and Fermions* which warns that this is not a run-of-the-mill textbook on quantum many-body theory but rather a passionate advocacy for a point of view where what is usually regarded as fundamental interactions are in fact emergent collective phenomena of an underlying stratum. Thus the book is similar in spirit, but absolutely not in content, to e.g. Grigouri Volovik's *The Universe in a Helium Droplet* from the same publisher. For Professor Wen, the underlying process is condensation of bosonic extended objects, mainly strings, producing a new kind of order called quantum order. Different quantum orders are characterized, partially at least, by 'projective symmetry groups', a kind of a twisted product of a symmetry group and a gauge group. The paradigmatic (and only?) example of a quantum order is the fractional quantum Hall effect, but Wen goes on to show that something akin to the standard model of particle physics, including gauge fields