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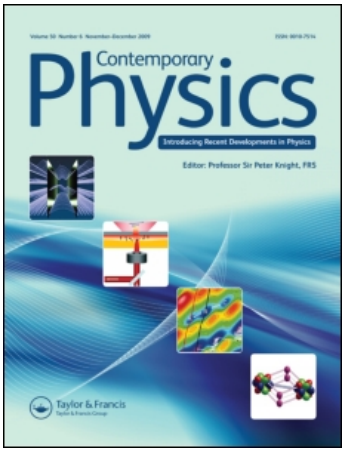

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Building Scientific Apparatus, 4th edition, by John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra E. Greer

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personal purchase by physicists and nonlinear dynamicists, especially those working or teaching in the area of self-organisation.

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Measured Tones: The Interplay of Physics and Music, 3rd edition, by Ian Johnston, Boca Raton, CRC Press, 2009, 454 pp., $59.95 (hardcover), ISBN 978-1-4200-9347-6. Scope: monograph. Level: general reader.

Musical notes permeate our society today. My car indicates that the lights have been left on with a pleasant dinging, my mobile phone attracts my attention with a polyphonic melody and my computer complains to me with a peremptory beep. This is even before we start to consider more traditional music with its different styles and the instruments which are used to produce it. If you have ever wondered why we use the notes we do, why instruments sound different and why they are constructed as they are, look no further: *Measured Tones* will answer many, if not all, of your questions.

Ian Johnston has managed to appeal to a physicist with an interest in music, to a musician with an interest in physics or even a general reader who is merely interested. The subtitle is particularly apt as the book takes a more or less historical path to consider the interplay of physics and mathematics with the music of the period.

The first question to be tackled is why we use the scales we do. The second is how and why scientific method and music are inextricably linked. To make measurements and draw conclusions a given level of scientific ability is required. It is from those early measurements and the associated conclusions that the story starts. It continues in an historical context with short biographies of the key figures and well thought out descriptions of their achievements. Very simple mathematics is dealt with in the text with slightly (and only very slightly) more involved treatments relegated to the appendices.

The strict chronological stream of the narrative is broken up with a series of 'Interludes' which are interleaved between chapters. Each interlude deals with a particular type of instrument. There are thus interludes on brass, the piano, the violin, acoustics in architecture, woodwind, percussion, electronic instruments and the voice. This structure may appear at first sight to be very fragmented but it works surprisingly well. A given interlude is chosen to illustrate and develop ideas which were introduced in the chapter immediately preceding.

I was particularly intrigued by the links that were drawn out between the frequency components present in chords, especially what we hear as 'pleasant', and how these relate to the anatomy and physiology of the ear itself. Towards the end of the book we are in a position to put all these ideas together and consider dissonances in music in order to account for why music may have developed the way it has in other cultures, such as the gamelan music of Indonesia.

The text is accompanied by figures and tables which are clear and consistent throughout (except for one small exception). Some of the illustrations are familiar reproductions of historical pictures. The original diagrams, however, are extremely clear and add significantly to the text.

I was irritated by one or two small things but fortunately they do not detract significantly from this fascinating and well-written book. The author, for example, has a habit of referring to 'spectrums' rather than 'spectra' and there is a small inconsistency in the labelling of tables. We are also, in one case, referred to the wrong appendix but it is reasonably obvious where one should look instead. Finally I suspect that 'cochlear transplant' should read 'cochlear implant'.

The most jarring note for me, however, is unlikely to be noticed by many readers. In the interlude on brass instruments the comment is made that ' ... *in the 20th century it [the trombone] gained a new prominence in jazz groups and swing bands, mainly for the thing it can do that others cannot, play spectacular glissandos*'. As a trombone player myself I naturally took exception to this: the trombone is popular for much more than merely a *glissando*, whether spectacular or not!

I devoured the book from cover to cover and thought overall that it was a wonderful read. It is exactly the sort of book that I hope someone would buy me as a present (if I did not already have a copy). It is now a treasured part of my personal library.

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Building Scientific Apparatus, 4th ed., by John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra E. Greer, Cambridge, Cambridge University Press, 2009, 662 pp., £45.00 (hardback), ISBN 978-0521-87858-6. Scope: reference. Level: anyone using, designing, modifying or specifying scientific apparatus.

Scientific instrumentation is in a continual state of evolution. Pioneers in a field build the apparatus they require, apparently out of sealing wax and string. One only has to look at a picture of the original solid state transistor to realise how these developments are made and how far we have come. Early nuclear magnetic resonance spectrometers were built by users whereas they have evolved into off-the-shelf items, given an appropriately large shelf, of course.

Building Scientific Apparatus is a book for pioneers, for the 'intelligent designers' of scientific apparatus. It is, however, not exclusively for those building apparatus from scratch. There is a wealth of nuggets of information for those faced with the task of adapting or even replacing parts in other instruments. A quick dip into this treasure trove can also help when one is buying new apparatus or talking to craftsmen such as mechanical engineers or glassblowers as it enables the novice to ask pertinent questions. In fact, students should be encouraged to use the book to help them understand how their apparatus was designed and how the materials were chosen.

The book is arranged in eight chapters: Mechanical Design and Fabrication, Working with Glass, Vacuum Technology, Optical Systems, Charged Particle Optics, Electronics, Detectors and Measurement and Control of Temperature. Each is broken down into subsections which contain tables of properties of materials, equations, rules of thumb and design tips. Each chapter concludes with a comprehensive series of references for further reading. The structure allows information to be located with little effort but for something specific there is also a comprehensive index.

The chapters cover physical principles and the criteria for design and component selection. The parameters used by manufacturers to specify their products are also explained with tables of data where appropriate. There are detailed explanations of techniques such as mechanical drawing, soldering and glassblowing. (I thoroughly recommend trying out the last: it is more difficult than it appears but remarkably satisfying.) In addition, manufacturing techniques are covered in order to compare the relative merits when different methods may be used to achieve a similar end.

The style of the book is informative without being condescending and the authors manage to pack in an impressive amount of information, data and design tips. The worked examples are especially useful to the novice. I have a particular fondness for the diagrams. These have retained the hand-drawn style of the original. This choice helps convey the feeling that all these designs are within the scope of a group of collaborators with the back of an envelope handy. What particularly jarred, therefore, was the inclusion of a computer generated schematic in the lasers section. Having spotted this I tried to find other examples but fortunately it appears to be the only such lapse. I spotted one or two minor typographical errors but these are very few and far between and do not detract from the text.

The authors mention companies by name from time to time as supplying particular components or materials. This will, of course, mean that any given edition will date but I do not believe that this will be a particular problem. If nothing else the names will help locate contemporary suppliers if the companies no longer exist in that form in the future.

Every research group in the physical sciences should have a copy available. I would recommend the purchase of the hardback edition: this is a book that should be subject to a great deal of wear and tear and the hardback edition is well made and appears that it will stand up to handling. It is not a volume to be read from cover to cover. It is, however, a fascinating and extremely useful reference work. Anyone who works with scientific apparatus will benefit from this book, undergraduate students, professors, technicians and postdocs. If you do not have one already, buy one now!

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Fundamentals of Medical Imaging, by Paul Suetens, Cambridge, Cambridge University Press, 2009, viii + 253 pp., £75.00 (hardback), ISBN 9780521519151. Scope: textbook and reference. Level: undergraduate, graduate and practicing scientist/engineer.

This book is aimed at graduate and advanced undergraduate students who wish to study the variety of medical imaging techniques in clinical use. Students with a background in mathematics, physics or engineering will benefit most from this book; however, readers from other backgrounds will also find it informative.

Starting from a reasonably elementary treatment of digital image principles and image operations, the book progresses with chapters devoted to the major imaging techniques in clinical use. Chapters are devoted to: radiography, X-ray computed tomography, magnetic resonance imaging, nuclear medicine imaging and ultrasound imaging. The final two chapters are devoted to medical image analysis and visualisation for diagnosis and therapy.