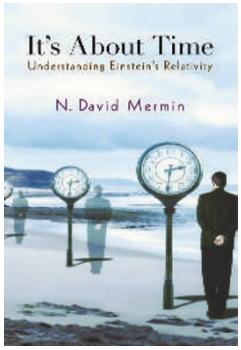
Time for maths



IT'S ABOUT TIME — UNDERSTANDING EINSTEIN'S RELATIVITY
BY N. DAVID MERMIN

Princeton University Press: 2005. 186 pp. $35

In recent years, many popular science books have appeared that attempt to make scientific ideas accessible to the general public. Although this is an entirely laudable endeavour, it has had both a positive and a negative outcome. On the positive side, more people now have a better understanding of the bigger picture of the universe we inhabit, which science has made possible. However, these popular accounts use analogy and everyday language to try and get across difficult scientific ideas, and the problems occur when they seem to succeed. Readers will get the analogy and believe that, as a consequence, they fully understand the underlying concepts. But the analogy can only take you so far. Unfortunately, if you wish to completely understand a physical theory then you need to understand the underlying mathematics. One manifestation of this limited understanding is that professional scientists receive a constant flow of 'crank' mail (or more likely e-mail) from interested readers who believe they can enter the debate at the level of the popularizing account. Generally speaking, they cannot.

David Mermin takes us on a trip through the special theory of relativity. The good news is that his account is sound and you would probably end up having a good understanding of the theory if you worked through his book conscientiously. The account is engaging, he has a very readable style and introduces some novel approaches to explaining key ideas. In 1968 Mermin wrote a book on special relativity aimed at high-school students, but he became increasingly dissatisfied with it while teaching courses to non-scientists at Cornell over the past three decades. In this new book he wanted to write an accessible account that concentrates on the concepts and downplays the mathematics. Unfortunately, I do not think he quite pulls it off. In another book on special relativity, also aimed at high-school students, Les Marder goes straight into a mathematical presentation; his account is both complete and authoritative. Despite his resistance, in the end Mermin has to bring in the mathematics, which he does in an almost apologetic manner.

In pedagogical terms, what has probably changed most since 1968 is the agreement that the best way to teach special relativity is through the judicious use of space–time diagrams. Mermin agrees on this too but, unfortunately, he does not introduce them until more than half-way through the book. I believe they should be introduced from the outset. Again, rather than start from using radar methods to coordinate events, or from Einstein's two postulates, Mermin chooses some simple collision experiments. The problem with this approach is, although it is both intuitive and intelligible, you need to modify the explanation as you go.

I found the chapter on $e = mc^2$ the least satisfactory. Introducing mass into special relativity is always somewhat tricky, but Mermin's account is particularly *ad hoc*. A statement on collisions such as "Many experiments establish the extremely important fact that the comparative size of two changes in velocity is entirely determined by the comparative size of the two masses" is only the first of a number of assertions used to enable him to derive the usual formulae.

In short, if you work through this book successfully then you will probably end up with a good understanding of much of special relativity, but you will still need to confront the underpinning algebra and geometry. You might as well face up to this from the start, and I believe that if you do then it will take you a quarter of the effort.

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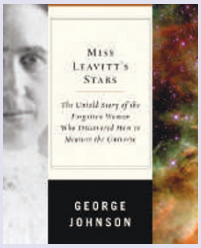
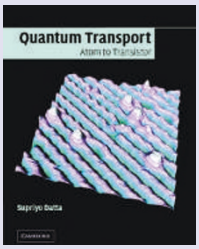


Miss Leavitt's Stars: The Untold Story of the Forgotten Woman Who Discovered How to Measure the Universe by George Johnson Atlas Books/W. W. Norton & Company: 2005. 162 pp. $22.95

Henrietta Swan Leavitt identified the Cepheid variable stars and lit the way for others, including Edwin Hubble, to realize that our galaxy is only one of billions in the Universe.



Quantum Transport: Atom to Transistor by Supriyo Datta Cambridge Univ. Press: 2005. 418 pp. $70

Datta's book covers the physics that governs electrical transport on scales ranging from that of atoms probed with a scanning tunnelling microscope, to that of the transistors on a silicon chip.

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