help their clients evaluate research performance.

Way back in 1976, Francis Narin of Computer Horizons came up with *Evaluative Bibliometrics: The Use of Publication and Citation Analysis in the Evaluation of Scientific Activity*. Both Narin and CHI were involved in the Science Indicators project of the US National Science Foundation, especially in developing literature-based indicators. Narin's report was largely based on CHI's own work.

In the summer of 1997, the Office of Naval Research, USA, released the seventh edition of *The Handbook of Research Impact Assessment* (DTIC Report Number ADA296021) by Ronald Kostoff. It was a comprehensive document that examined the myriad approaches for assessing the impact of research. The handbook described evaluation of research impact for three cases: research selection, where the work had not yet been performed; research review, where work and results were ongoing; and ex-post research assessment, where research had been completed and results could be tracked. It described retrospective methods (such as projects Hindsight and TRACES), qualitative methods (such as peer review), and quantitative methods (such as cost-benefit analysis and bibliometrics). Dividing the approaches into the three major categories, viz. qualitative, semi-quantitative, and quantitative, Kostoff presented the theoretical background for each approach, as well as illustrative examples.

Much has happened since then, and now Henk Moed, a key figure of the famous Leiden Centre for Science and Technology Studies, has come up with this book, entirely devoted to citation analysis-based evaluation of essentially basic research. This book is written for the scholarly research community and people involved in research evaluation and policy. By policy, Moed means science policy at the national, organizational and departmental levels. Moed has attempted to contribute to the academic basis of evaluative bibliometrics by presenting it as a multidisciplinary scientific–scholarly activity, with its own methodologies and theoretical debates.

The book should be especially useful to practitioners of scientometrics in India, where it seems that everyone graduating from a library school thinks he or she can become an expert in research evaluation overnight. Warns Moed, 'Applying citation analysis in research evaluation in a proper way requires a high level of competence. It is not something that anyone with access to the ISI Citation Indexes can do easily'. Moed provides detailed technical knowledge needed to carry out such studies.

Some micro-sociologists question the validity of citation analysis, but Moed aims to show that citation analysis is a useful tool. He explores the uses and limits of citation analysis and explains the construction and application of a variety of indicators. He examines differences in the structure of written communication systems of different fields of scholarship. After all citation indexes cannot be applied to scholarship in art and music as well as it can be applied to physics and biology. Moed discusses in detail the journal coverage of ISI's databases and tells why raw data from the databases cannot be used straightaway in citation analysis. We need to find alternative databases or develop them, if none exists.

Moed describes four kinds of bibliometric studies; one has to be judicious in deciding which one is suitable in a given context. Moed devotes considerable space to provide a clear understanding of impact factor, need for data accuracy and what citations measure. He also discusses recent trends in developing indicators and touches in passing, citation analysis in an age of electronic information.

On the whole, this is more than a textbook drawing upon years of research the author and his colleagues have done. Moed has also drawn from the research of others and has included a brief note on data accuracy by Garfield.

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It's About Time – Understanding Einstein's Relativity. N. David Mermin. Princeton University Press, 41 William Street, Princeton, NJ 08540, USA. 2005. 192 pp. Price: US$ 18.95.

The genesis of the theory of relativity has become one of the most enduring legends. In 1905, working in the seclusion of the patent office in Bern, Einstein wrote his celebrated paper 'On the electrodynamics of moving bodies', proposing his special theory of relativity. The revolutionary ideas contained in that paper, especially the relativity of time, were destined to change radically the world view prevalent at that time. The paper itself is extraordinarily simple. The mathematics employed is no higher than the level at which it is taught in high school. The basic concepts are profoundly simple, especially Einstein's arguments at the beginning of the paper regarding the synchronization of clocks, simultaneity, and the variation of time measure among inertial observers moving with constant relative velocities. These ideas naturally lead to Lorentz transformations that yield unexpected results.

In its simplicity, the book by David Mermin follows in Einstein's footsteps. Mermin is an eminent physicist who has made important contributions to several branches of physics, including condensed matter theory and the foundations of quantum mechanics. His writings are known for their clarity and wit. Furthermore, he has had decades of experience as a gifted teacher at Cornell University. The book *It's About Time* is the outcome of Mermin's successful endeavour to teach relativity to high school students. The mathematics used is just the high school-level algebra and geometry, that too of the most elementary kind. The approach to the physical ideas of observation and deduction is intuitive, although they yield all the counter-intuitive results of relativity.

As a precursor to the different aspects of special relativity to follow, we have here a lucid discussion of the basic idea of relativity. Historically, spatial relativity was formulated by Galileo and was made precise by Newton through his equations of motion. However, time was assumed to be the same for all inertial observers moving with constant relative velocities. The discussion of Newtonian relativity is followed by examples of collision between two billiard balls as viewed from a frame at rest and from a moving frame. The principle of relativity used in the analysis of these examples prepares the grounds for further explorations leading to the rather unusual results of Einstein's relativity as a consequence of time changing among different inertial observers.

Most basic to Einstein's theory of relativity is the speed of light. Mermin treats this important feature of the theory in his characteristic precise and illuminating manner. Once again, after touching upon the historical background of the meas-

urement of the speed of light, he discusses the assumption of the existence of ether as the medium for the propagation of light and the failure of all attempts to detect this elusive entity. This of course led Einstein to formulate the principle of constancy of the speed of light, one of the two postulates of his theory. This principle enters into fundamental ideas such as the synchronization of clocks. From here on, we have chapters dealing with various aspects of relativity theory such as Einstein's velocity addition theorem, simultaneous events, slowing down of clocks in a moving frame, and the idea of time-like, space-like, and light-like intervals. These discussions naturally lead to the most important development in relativity theory after its formulation, namely the fusion of space and time into a single entity space-time by Herman Minkowski, Einstein's former mathematics teacher at the Zurich Polytechnic. Initially Einstein did not seem to be enthusiastic about this development, saying that he 'no longer understood relativity, now that mathematicians have invaded the field'. Nevertheless, he was soon to realize how indispensable it was for the formulation of his general theory of relativity. Space-time diagrams, initiated by Minkowski himself, lend themselves eminently to the elucidation of many relativistic effects. This is demonstrated here considering many examples of relativistic phenomena. Now comes perhaps the most famous equation in all of science, namely $E = mc^2$. In dealing with this equation, Mermin introduces quite a bit of relativistic physics involving energy, momentum, characteristics of a photon, and so on. After a short introduction to Einstein's general theory of relativity, the book ends with what may be termed as a summing up. This chapter touches upon the role of relativity in different branches of physics, such as the theory of elementary particles and brings into focus the lessons to be learnt from the theory of relativity as an example of the process of exploration.

As mentioned earlier, the book is an outcome of decades of teaching and not just an intellectual exercise. This means that it has gone through the grind of clearing the doubts of students, however intelligent they might have been, and making sure that the ideas were put across in a succinct and lucid manner. In addition, the methods employed are necessarily highly innovative since the usual method of deriving everything from the Lorentz transformations is completely avoided. Using the book would be a highly novel experience to both teachers and students alike.

The book raises several questions regarding its use. What purpose would such a book as this serve? The most important function of the book is to train students in the precise study of physical situations, in the present case as viewed from frames of reference at rest and in motion, in order to extract information related to the different results obtained by different observers. This no doubt sharpens and focuses one's analytical thinking, which is indispensable for original exploration. Besides, it adds to the demystification of counter-intuitive effects encountered in relativistic physics. Can this be used as a textbook? It cannot supplant regular textbooks dealing with relativity. Sooner or later, one has to learn the full mathematical machinery underlying relativity in order to apply it successfully. Who would benefit from studying this book? First of all, it is those students who are seriously interested in learning relativity theory who would find the book a valuable companion to their textbooks. In as much as every good teacher is a student himself, teachers would gain a lot, especially if they are oriented towards discovering new and innovative methods of instruction. As a matter of fact, anyone interested in relativity, including experts in the field would profit from the book. You never know what new insights one might gain by following a new pathway leading to old results. Can one and should one teach relativity at the high school level? Obviously, Mermin has been successful in this endeavour. The sooner you introduce important aspects of science to the students, the better. However, this cannot be done on a large scale. Students will have to be gifted enough to learn and understand what is being taught. But then, this is the criterion to be satisfied by anyone who wants to pursue science seriously. The most important question for us is perhaps in regard to the relevance of this book for education in our own country. Who might use this book as an aid in teaching relativity, if not as a textbook? It is not unknown for relativity to have been introduced at the high school level, essentially aimed at select talented students. In the case of such an unusual venture, the book might come in handy. On the other hand, it would be exceptional indeed if a regular teacher in a college or even in a university were to include this book as part of course work. Who then would be the most natural choice for using this book for teaching relativity? As in the case of David Mermin, it would have to be a practising physicist. Research and teaching go hand in hand in the West. But, how about our own country? In this context, one has to confront the all-important question as to how many of our scientists are genuinely interested in teaching in the first place. At the graduate level? At the undergraduate level? At the high school level? Unless this question is taken seriously and the situation is redressed, there is no point in deploring the state of science education in our country, complain about the dearth of motivated students, and indulge in the Utopian dream of raising our educational and research institutions to the level of Cambridge and Harvard. That, perhaps, is the most important lesson that one learns from Mermin's book.

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