

## Relativity for students

**Relativity: An Introduction to the Special Theory.** Asghar Qadir. World Scientific, Singapore.

There is no dearth of excellent textbooks on special relativity, yet there are few that are ideally suited for students from this part of the world. Their background is very different from that of students in Europe and the USA. There is therefore a need to develop the subject from scratch, keeping the background of our students in mind. This is, to my mind, best done using a historical perspective in order to arouse the students' interest and give them a better 'feel' for the basic concepts on which the theory is based. Asghar Qadir's book does just that. It is based on the series of lectures the author gave for MSc students over several years at the Department of Mathematics, Quaid-i-Azam University, Islamabad, Pakistan. Asghar Qadir has had the good fortune of working with two of our time's best-known relativists, Roger Penrose and John Archibald Wheeler. He is himself well known for his contributions to the subject. His mastery over the subject comes out clearly in the book.

He defines special relativity as the study of uniform motion. As such, it deals with 'kinematics' rather than 'dynamics'. The author therefore begins

the book with a delightful and short historical background of motion and time dating back to Aristotle and bringing the student up to pre-relativistic mechanics, with a short digression on the scientific method. The successive chapters deal with Einstein's formulation of special relativity, requiring no more than high-school algebra, a bit of tensor theory required for the four-vector formulation, applications of special relativity, electromagnetism in special relativity, and special relativity with small accelerations. The background required to follow these chapters is a knowledge of matrices and vectors, of differential and integral calculus and the rudiments of group theory. Virtually no background of physics is assumed except for some classical mechanics and a nodding acquaintance with the formalisms of Lagrange and Hamilton. Each chapter is followed by a list of very carefully selected exercises to enable the student to acquire a good grasp over the basic concepts and techniques.

A delightful feature of the book is the clear treatment of the famous 'paradoxes' of special relativity. According to Webster, the word 'paradox' can mean either of two things: (i) a statement that seems contradictory, absurd, etc. but may be true in fact, or (ii) a statement that contradicts itself and is false. The

word 'paradox' in the relativistic context must be understood in the first sense. The author clearly distinguishes between two types of these paradoxes. The famous clock (or twin) paradox as well as the paradox about the two observers near a smooth table-top with a hole, of diameter  $l$ , watching a thin rod of length  $l$  coming towards the hole are examples of the non-equivalence of two observers arising from the effects of acceleration or gravitation (which is locally equivalent to acceleration). On the other hand, the paradox of the barn is based on (as the author puts it) 'not adverting to the relativity of simultaneity'.

There is one inadvertent error that I have noticed that may confuse the reader. It occurs on page 22 just after the statements of the two assumptions (a) and (b) made by Einstein. The sentence reads: 'An "inertial frame" is a frame of reference in which Newton's second law of motion holds'. It is clear from the context that the author meant Newton's *first* law!

I wholeheartedly recommend this instructive and 'enjoyable' book to our students. This, of course, does not mean that students in developed countries will find it any less valuable.

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## Carcinogens

**N-Nitroso Compounds: Biology and Chemistry.** S. V. Bhide and K. V. K. Rao, eds. Omega Scientific Publishers, Sunder Nagar Market, New Delhi, 224 pp. Price: India Rs. 240; elsewhere US \$ 24.

The Indian Association for Cancer Research and the Environmental Mutagen Society of India sponsored an international symposium at Bombay in June 1989. Twentyone papers presented at the symposium make up this book.

The first two sections, viz. 'Nitrosamines in food and endogenous nitrosation' and 'Tobacco and nitrosamines' comprise papers concerned with the occurrence and analysis of N-nitroso compounds in foods and tobacco, and epidemiological studies on cancers

related to tobacco, with special reference to endogenous formation of N-nitroso compounds in tobacco users. Although these studies were made in the Indian context, they are relevant generally in identifying and estimating N-nitroso compounds in the environment. The sections 'Model system' and 'Mechanism studies' highlight the importance of N-nitroso compounds as valuable tools in basic cancer research and some of the presentations here will contribute to our understanding of the cellular and molecular mechanisms that induce cancer. Under the section 'Modulation and chemoprevention', an interesting paper reports the anti-carcinogenic properties of betel-leaf extract. Modulation of mutagenic properties by antioxidants is the subject of another study. The effect of nutritional

status on the excretion of mutagens, specifically the effect of deficiency of vitamin A on tobacco-related cancer has been detailed in two papers.

Widespread occurrence of N-nitrosamines and their precursors, their endogenous formation in humans are well recognized. Epidemiological evidence overwhelmingly points to them as potent carcinogens, especially in the case of oral cancers. This volume should generate wide interest among Indian scientists, although there are currently very few groups working in this area in India. The basic studies presented here should add to the literature on cancer research in general.

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