in a group whose interests, social conventions and special vocabulary one did not share. What actually is going on? Not so much a discussion concerning bias in mental testing, more an attempt to work through some of the difficulties arising from the custom of classifying both oneself and others as belonging to a specific racial group, and most particularly the consequences in the United States. Sex and social class differences don't even merit entries in the index. Of course it is clear why racial differences, particularly when group membership can be imputed on cursory inspection of the face, have dominated the argument. But when arguments run dry and the evidence on either side gets thin, prejudices surface in the description of inconclusive data by all sides in the debate. It is difficult to shake off the impression that with few exceptions pro- and anti-test contributors alike seek support from research for positions they would hold to regardless of the evidence. The fact that at present the weight of evidence is firmly on the side of the hypothesis of no bias does not dispose of a sense of unease about why these authors take such an interest in the question of racial differences in the first place. One scarcely wants to see ethnic origin as the principal defining characteristic of one's fellows.

Invariably linked with the test bias issue, although for no good logical reason, is the question of the heritability of IQ. It is to be regretted that a slippery slope of unreason leads from the affirmation of no test bias to the assumption that IQ differences across races are fixed genetically and not susceptible to modification, and thence to the conclusion that blacks are an inferior breed. It is surely incumbent on those whose reputations rest on their publications in this field to signpost very carefully and clearly the limits of the arguments they put forward. Equally, those who continue to assert the presence of bias should clearly state whether it is only ethnic groups which must, *a priori*, have equal mean scores on tests, or whether all group memberships are necessarily random with respect to IQ.

One can only welcome the appearance of this book: how many will have the stamina to read it all is another matter. □

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Standard physics

C.J.S. Clarke

Supermanifolds. By Bryce DeWitt.
Cambridge University Press: 1984.
Pp.316. £35, $59.50.

THE main difficulty in reviewing this book was fending off colleagues and students trying to get their hands on it. For, although supermanifolds have played a large part in theoretical physics over the past few years (and are predominant in modern theories of quantum gravity), this is the first textbook to be devoted to the subject. Having been circulated in part as dog-eared photocopies for some time, the finished version has been eagerly awaited.

The book begins inauspiciously, however. There are now five essentially different definitions of supermanifolds on the market (those of Kostant, Rogers, Jadzyck-Pilch, Batchelor and DeWitt). A few conjectures and theorems link them, but they differ in the choice of the definition of "differentiable" when applied to functions taking values in a Super-Euclidean space made up of both commuting and anticommuting coordinates. Here, although some of the other contenders are given a passing reference, there is nothing to suggest to the reader initially that there could be any alternative to DeWitt's own theory. Differentiability is swept away on p. 3 where the author first asserts that his basic (infinite dimensional) vector space has neither norm nor topology, and then proceeds to differentiate functions on it!

But this problem in no way detracts from the excellence of the subsequent exposition of the geometry of supermanifolds. All the properties with which workers in general relativity are familiar, including connections, geodesics and curvature, are dealt with for supermanifolds in a strongly geometric spirit, using a very efficient notation. Super-Lie groups are given a most thorough treatment, including specification of the analogues of the classical Lie groups. The book ends with a discussion of physical applications to Bose–Fermi-interchanging symmetries. Here some might harbour mathematical doubts as to the propriety of some of the manipulations of path-integrals, but in comparison with the standards of mathematical validity prevailing in much of theoretical physics today DeWitt's treatment looks positively rigorous.

In the scope of its geometric development, DeWitt's analysis goes well beyond that of the other theories mentioned above. And at the level of basic structure there are several interesting additions not found in the mathematical literature, such as the stress on the use of complex super-vector spaces having a conjugate-linear automorphism, and the systematic use of super-Hilbert space for quantum mechanics.

Each chapter contains a set of exercises, making it possible to use the work as a self-contained graduate text. *Supermanifolds* is destined to become the standard work for all serious study of super-symmetric theories of physics. □

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Something missing

George Efstathiou

The Hidden Universe.
By Michael Disney.
Dent/Macmillan, New York: 1984.
Pp. 216. £10.95, $16.95.

IT was about time that a popular book appeared on the "missing-mass" problem. There is now considerable evidence that more than 90% of the mass of the Universe is invisible, but nobody knows what this dark stuff is made of. Is it dead stars, low-mass "stars" which never ignited, hot gas, black holes or perhaps elementary particles such as neutrinos?

Michael Disney explores all of these possibilities, summarizing the various observational limits and theoretical arguments which have narrowed the range of acceptable candidates. But in my view he fails to convey the great sense of excitement and the rapid progress that have characterized recent years. For example, current observations imply that the average density in the Universe is about a tenth of the critical density predicted by Einstein's General Theory of Relativity. Isn't it possible that undetected dark matter can make up the difference? This is certainly Disney's view, but it is given additional respectability by new theories of the early Universe — the so-called inflationary models. It is a shame that these are only briefly mentioned in the last few pages of the book.

Moreover, the discussion of particle theories and their impact on modern cosmology is far too scant. Disney gives the impression that nearly all the proposed candidates suffer from some weakness and that we should consider more radical alternatives, such as abandoning Newtonian gravity. However, some of his theoretical arguments are either weak or wrong. For example, Disney argues that massive neutrinos would cluster strongly around galaxies, but he ignores phase-space restrictions and the fact that neutrino fluctuations are damped on galactic scales. Further, many exotic forms of dark matter, such as gravitinos, photinos and axions, are not even mentioned.

Of course it is all too easy to criticize. The author has clearly spent a great deal of time in carefully constructing analogies to explain complex points to the layman; the sections on stellar evolution are particularly clear. Disney presents a good picture of modern observational cosmology — the difficulties, the uncertainties and the controversies — and if some of the more glaring errors and omissions were corrected this would be an excellent book. □

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