

antirealism, because, like a Humean skeptic, the antirealist may hold that quantum physics does not deal with causes but with phenomena only, and in a world without causes, 'anything goes'. In the event, however, Mayants ends up making sweeping statements which a more careful analysis may show to be wrong.

The chapter entitled 'Personality versus society' of the book seems out of place in what purports to be an account of the way out from the quantum-mechanical paradox, unless the author intended to show that he was demolishing the myths, he saw, of quantum mechanics, in much the same way as he would demolish the myths perpetrated in the name of dialectic materialism and social formation under communism!

All said and done, the principal principle enunciated by Mayants is something to be kept in mind when talking about probabilities and statistics in quantum mechanics, as in any probability-based theory, but, in spite of claims to the contrary by the author, this in itself can hardly be expected to obviate the need for further analysis of the foundational aspects of quantum mechanics.

The final answer, instead of lying with Mayants, may indeed lie somewhere else, based as it would be, on a more careful analysis of issues such as the superposition principle and entanglement, time evolution and reduction of wavefunction, and, of course, nonlocality, and then it would indeed be found, as shown by Redhead⁵, that 'quantum mechanics has landed some pretty queer fish'.

1. Mayants, L. S., *Found. Phys*, 1981, 11, 577.
2. Aspect A. *et al.*, *Phys. Rev. Lett.*, 1981, 47, 460; 1982, 48, 91; 1982, 49, 1804.
3. Pitowsky, Itamar, *Quantum Probability, Quantum Logic*, Springer, Berlin, 1989.
4. Strauss, M., *Modern Physics and its Philosophy*, Reidel, Dordrecht, 1972.
5. Redhead, Michael, *Incompleteness, Non-locality and Realism*, Clarendon, Oxford, 1990

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The Action Principle in Physics by R. V. Kamat. IPA monographs in physics series. New Age International Publishers Limited, Wiley Eastern Limited, 4835/24 Ansari Nagar, Daryaganj, New Delhi. pp. 201. Price: Rs 400/-.

Given the large number of students which flock to various postgraduate departments in Indian universities every year, the near total lack of books by Indian authors written specially for Indian students, either as basic textbooks or for supplementary or follow-up reading, is quite remarkable. While it is certainly true that most of the students would rather watch TV than study books in their spare time, and bogged down with heavy course loads as they are, certainly not 'outside-the-course' monographs, this is not a sufficient explanation. For, even if only, say, 5% of the students are seriously interested in their subjects, we are still dealing with large numbers. That they do not do so much is partly because reasonably priced books, pegged at an appropriate level, are not easily available. Clearly, here is a Catch-22 situation.

While there are a large number of monographs of good quality published abroad, these are usually not available to Indian students. Most university libraries are in bad shape. The high price of books is a very major deterrent. Also, not many bookstores kept many specialized monographs in stock, and ordering them from publishers can take 6-9 months (who can afford air mail?). It seems quite unreasonable to expect a student to have sufficient patience and sustained interest for so long. 'In the final year, sir, we study other subjects.' The students are like that only.

The Indian Physics Association, by publishing monographs meant for Indian students of postgraduate level, or first year of PhD is providing a much needed input. The volumes are reasonably priced, and the prices, hopefully, could be brought down further if the series proves popular. It is reasonable to expect that Indian authors would have a much better understanding of mathematical or conceptual difficulties faced by Indian students and, thus, would be better able to adapt the material to our needs. It is an idea whose time has come.

The present volume is by R. V. Kamat, who has been teaching physics students in St. Xavier's College, Bombay, at both undergraduate and postgraduate levels for over 20 years. It deals with the action principle in classical mechanics, electrodynamics, general relativity and quantum mechanics. The book starts with simple problems in calculus of variation, e.g. the famous brachistochrone problem and Fermat's minimum time principle in geometrical optics. These chapters have a large number of problems, of which at least some will be enjoyed by interested readers. This is followed by discussions of Hamilton's principle in classical mechanics. This is a fairly standard fare for M Sc (Physics) students and is dealt with quite satisfactorily here, as also in most standard textbooks on mechanics. The next chapter deals with the action in classical electrodynamics, and derivation of Maxwell equations, starting from the corresponding action.

The author has been careful enough to recapitulate some of the concepts, and the covariant notation of the special theory of relativity. These are followed by chapters on the action principle for general relativity and for quantum mechanics, however avoiding a full-blooded path integral formulation (that would perhaps require a book on its own). A chapter on action-at-a-distance for much of electrodynamics, which avoids introducing electromagnetic field as a separate entity and defines direct but 'delayed' action-at-a-distance between charges (as proposed by Fokker and Schwartzchild and developed later by Wheeler and Feynman), has been added perhaps as a teaser for students to pursue the subject further.

The book is suitable for M Sc (Physics) or first-year M Phil students. It has a judicious mix of conventional 'textbook material', and somewhat more advanced topics which are usually found only scattered in different textbooks on electrodynamics and relativity of quantum mechanics. The book thus brings out an important unifying principle in physics, in a language accessible to students.

On the debit side, the price of the book at Rs 400 for 200 or so pages is not really low. The number of typographical errors is quite large for a textbook meant for students. It is hoped that

these will be corrected in the next printing. The problems in the latter part of the book are quite routine, of the kind 'verify Eq. 7.8'.

An important topic which has been omitted is the euclidean field theory, which makes contact with the minimization principle of free energy in thermodynamics. I think that it is technically, conceptually and, hence, pedagogically simpler as it deals with real integrals of the type $\int_{-\infty}^{\infty} \exp(-x^2) dx$, and not complex and not absolutely convergent ones like $\int_{-\infty}^{\infty} \exp(-x^2) dx$. Some jargon-free discussions of if and how causality is maintained even with advanced wave solutions in Chapter 8 would have been very useful, and also would have helped the students think about the physical ideas behind the mathematical formalism.

On the whole, the book is a welcome effort to bring good books to Indian physics students at a reasonable price. It is recommended for acquisition by libraries of institutions involved in physics teaching at M Sc or Ph D level, and also by students who want to go a bit beyond the conventional curriculum.

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Laboratory Manual of Organic Chemistry. Raj K. Bansal. Third Edition. Wiley Eastern Limited, New Delhi. 1994, 290 pp. Price: Rs 80.

An author who sets out to write a guide on practical organic chemistry for Indian universities is faced with a choice between two evils. Given the backdrop of a tradition-bound, rigid system (wherein innovation is frowned upon), the book has to meet the demands of the existing (though outmoded) syllabi to make commercial sense for both the author and the publisher, or face oblivion. An innovative guide which sets out to correct the course of practical organic chemistry within this country would have few takers. The bulk of the colleges (over

7000) are nothing more than factories churning out graduates within the rigid norms imposed by the examination systems, that establish a uniformly low level by sticking to the letter (not spirit) of the syllabi. The handful of autonomous colleges/institutions who have the resources to modify and innovate either do not have an undergraduate programme or have chartered their own different courses. Writing a book for this miniscule market makes no commercial sense. Unfortunately, what makes commercial sense has very little professional value. Chemistry being a professional science (which has given birth to several professions and even today continues to churn out new professions) should have a dynamic practical course to prepare students to meet the demands of the present job market and future challenges. One would like to see a practical guide which contains not only classical areas, including spectroscopy, but also a good sprinkling of professional skills such as clinical chemistry (biochemistry), pollution chemistry (air and water monitoring), detection of adulterants in food (forensic science) and some basic industrial chemistry. It should set out a model framework for undergraduate (UG) and postgraduate (PG) courses to make the practical courses relevant to the job market. Alas!! an author who sets forth on this trial would have to wait for the world around him to change, for no publisher would support such a venture.

It is against this background that one should view this book. While Bansal has kept in mind the overall needs of the Indian universities, there are some curious features. It is hard to see why any college would like to store 11.5×40 (students) = 460 g of picric acid prepared every year. Several such preparations appear to be there for old times' sake. The analytical organic chemistry experiments baffle this reviewer. Let us assume 14% nitrogen/sulphur/halogen in a given organic compound. If one takes 2 mg of sodium and an equal quantity of the compound (but does not the grand master A. I. Vogel state that the compound should be added to molten sodium) per ignition tube and 15 ml of water, one could hardly expect 0.02 mg of cyanide/sulphide/halide, assuming 50% reaction (which is impossible under the conditions) Should

one depend on precipitation tests for sulphide? The existence of sulphocyanide in a very dilute alkaline solution is also questionable (if tests are performed as per procedures on pure organic compounds). In the same way, several other functional group tests are also of little practical value. The heavily curtailed list of common organic compounds indicates clearly that the author wishes to weed out items which are seldom given for UG and PG classes. This laudable objective could have been stretched to other procedures such as estimations. The section on organic preparations has several important and useful procedures for classroom work. Considering the financial crunch, the scales of these preparations are generally large. The section on spectroscopy stands alone without connectivity. The cost of organic analysis could be drastically reduced and the training made more realistic to real-world situations by combining classical and spectroscopic approaches. After N, S, halogen test and m. p. determination, the student could analyse the given (photocopy) infrared (IR) spectrum. The functional groups deduced from IR could be confirmed by chemical tests and derivatization. Listing the derivative under different functional groups could send wrong signal to students. For example, the phenolic group is identified by the FeCl_3 test, solubility tests and preparation of a benzoyl derivative. However, an easy derivative for some phenols (and aromatic amines) could be via nuclear bromination. A good derivative for quinol is *p*-quinone, by FeCl_3 oxidation. Some glaring errors in figures and structures in this third edition could have been avoided (e.g. water pump (p. 11), thiourea (p. 142), α -bromo- β -naphthol (p. 158), piperine (p. 236), etc.).

Notwithstanding some drawbacks, the book meets the demands of most of the syllabi. The discussions and procedural details have been trimmed to a minimum to keep the book affordable to students, who should also find the discussions on mechanisms and chemical equations very useful in understanding the procedures. As frequently suggested in the text, the instructor should provide supplementary guidance, bearing in mind that brevity has its own pitfalls. On reduced scales, the experiments on