

chapters in a commendably systematic way, starting in the first three chapters with the simple cases of "dry" convection, caused by local heat sources (laminar and turbulent plumes), and by distributed heat sources (including the Rayleigh-Bénard problem of convection in a fluid between horizontal plates maintained at different temperatures, where theory is at its best). The technicalities of the theory of "moist" convection involve subtle thermodynamic considerations, through which the reader is carefully guided in chapters 4 to 6, as a preliminary to a discussion in the main part of the book (chapters 7 to 14) of the dynamics and thermodynamics of cumulus and other types of clouds.

About 30 years ago, two leading dynamical meteorologists introduced the concept of CISK ("conditional instability of the second kind"), according to which moist convection in the tropical atmosphere was controlled by large-scale circulation through mechanical interactions in the frictional boundary layer. The CISK idea greatly influenced methods used for parameterizing moist convection in numerical models, and it was not seriously challenged until comparatively recently, when Emanuel pointed out that CISK overlooks the simple fact that convection is a response to the generation of instability, not the supply of water vapor *per se*. The details of Emanuel's arguments can be found in his original papers, including the published version of his Symons Memorial Lecture to the Royal Meteorological Society in London (K.A. Emanuel, J.D. Neelin, and C.S. Bretherton, "On large-scale circulations in convecting atmospheres", *Quart. J. Royal Met. Soc.*, **120**, 1111, 1994). The arguments are well summarized in this monograph, which will be consulted by everyone interested in the complexities of dynamical meteorology and in the improvement of practical methods of climate and weather prediction.

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The Knot Book: An Elementary Introduction to the Mathematical Theory of Knots

Colin C. Adams
Freeman, New York, 1994. 306 pp.
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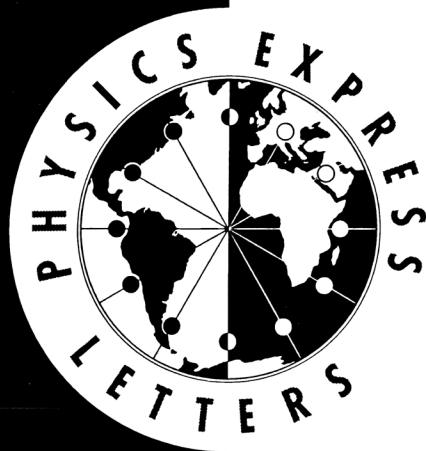
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and in its applications to various branches of physics: notably statistical mechanics, biophysics and quantum field theory. Following Vaughan Jones's work in unraveling the links between knot theory and statistical models and Edward Witten's contribution to knot theory and three-manifold invariants through Chern-Simons's field theory, significant expansions have taken place in this area. It is thus an appropriate time for a book that reviews these recent developments at a level appropriate for the nonspecialist. This book serves this purpose adequately.

Colin Adams is well known for his contributions to knot theory, and he has done extensive work in the computation of hyperbolic volume for three-manifolds. After going through *The Knot Book*, I got the impression that he has made an extra effort to simplify things so that the large, multidisciplinary audience he addresses will not be left out at any stage.

Introductory knot theory, as explained in the first six chapters, is simple enough to offer to non-mathematicians. The method of presentation there and throughout the book is very interesting: Proofs and explanations are presented through figures and intuitive arguments, following which the reader is given a set of exercises of varying degrees of difficulty. Readers are shown a glimpse of unsolved questions, which I feel is the most attractive part of this book. While the first three chapters are straightforward and flow smoothly, the fourth, on surfaces, treats its subject sketchily partly, I guess, because of the technical complexity of the material. The fifth and sixth chapters, discussing various types of knots and polynomial invariants, are well presented. However, there have been many new invariants since the Jones and HOMFLY polynomial invariants were introduced in 1985 that are simple to explain and could have been presented. Chapter 7 deals with interesting applications to biophysics, chemistry and statistical mechanics, but it is sketchy and ends abruptly.

The last three chapters briefly cover some of the modern developments in mathematics, such as classification of three-manifolds and higher dimensional knots. The book does not address the recent issues involving representation theory of algebras, Witten's quantum field theoretic representation of knot invariants or the role of quantum groups in the study of knots. It is understandable that some of the concepts would be extremely difficult to explain to a non-specialist audience, but it might be

worth the effort. The book *Knots and Physics* by Louis Kauffman (World Scientific, 1991) may prove useful in that respect. *The Knot Book* ends with an appendix on a partial list of diagrams of knots and links, a useful catalogue of Jones polynomials, and the hyperbolic volumes for those knots and links.

On the whole, *The Knot Book* is well written and will be useful for nonspecialists who are keen to understand the conceptual framework of knot theory and its applications. I completely enjoyed reading the book.

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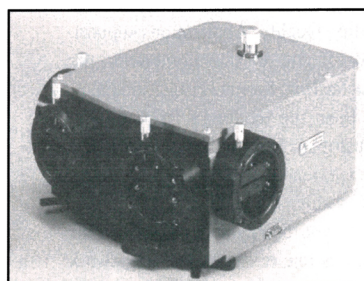
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