

Kolmogorov, Vladimir Arnold and Jürgen Moser (which became known as the KAM theory). They showed that if one starts with an integrable system that is nondegenerate in an appropriate sense and makes a small perturbation of that system, then there is a set of large volume in the phase space on which the motion remains as regular as it would be in the completely integrable case. The set of trajectories to which the KAM theory does not apply is of small volume but large importance. In particular, it typically has a very complicated shape and forms a sort of web that for arbitrary, small perturbations of an integrable system can nonetheless extend for unlimited distances through the phase space. Using this observation, Arnold was able to construct an example of a small perturbation of a completely integrable system with trajectories that wandered arbitrarily far from their starting point. This phenomenon, now known as Arnold diffusion, forms the centerpiece of this book.

The authors of the present volume have all been involved in elucidating the appearance and importance of this mechanism for producing chaos in various physical settings. Therefore, they are well qualified to survey this field, and in my opinion, the strongest sections of the book are those in which the authors explain how Arnold diffusion arises. They describe how separatrices (which are special orbits in the integrable problem) split up under perturbation and give rise to a tangled network that permeates the phase space and through which chaotic trajectories of the system may pass. They also describe approximate methods for calculating the extent of this web and the rate at which trajectories diffuse through it.

Preceding this description is a brief introduction to Hamiltonian dynamics. This serves as a useful brushup for someone already familiar with the area, but I suspect it is too brief to be of much help to someone unfamiliar with the subject. The authors then describe the formation of the stochastic web. This material is fairly standard and can be found in other books (albeit with different emphases), such as Allen Lichtenberg and Michael Lieberman's *Regular and Stochastic Motion* (Springer-Verlag, New York, 1983).

The book then goes on to treat a rather special topic, the existence of certain special Hamiltonian systems in which the stochastic web forms a quasiperiodic structure in the phase space. The only place in which these

topics seem to be covered, aside from the original literature, is in the review article "Weak Chaos and Structures" (*Soviet Scientific Reviews C* 8, 83, 1989) by the authors of the volume presently under review. The discussion of these structures and of similar phenomena in related models, such as three-dimensional fluid motion, takes up about half of the book. In these sections the authors discuss the relationship of these classical mechanical models to quasicrystals, and they draw an interesting relationship between the distribution of elliptic and hyperbolic periodic orbits in chaotic dynamical systems and the density of states in condensed matter physics. However, the real relevance of these particular quasiperiodic patterns for understanding the origin of chaos in Hamiltonian systems remains unclear to me because they appear to be rather unstable under perturbation of the parameters of the model, while the occurrence of chaos in such systems is a robust effect.

The book is generally well produced, with a large number of lovely figures of quasiperiodic webs. In addition, the final chapter contains very interesting pictures of similar quasiperiodic patterns found in nature and art; however, the scientific connection of this chapter with the rest of the book is rather tenuous.

Because of the somewhat specialized nature of much of the material, I would not recommend this book to someone wishing for an introduction to chaos in Hamiltonian systems. Rather, I expect it will be of most interest to specialists looking for a source for this material outside the original literature—the only other place much of it can be found.

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