Book Review


The evolution of planetary systems can be studied from the “inside” or the “outside”. Many readers of this journal study planetary systems from the “inside” by seeking to understand the evolution of our own solar system from material samples returned to Earth by space missions or falling to Earth by accident. Such studies provide detailed information about the formation of a single planetary system 4.56 billion years ago. Many astronomers are studying a myriad of planetary systems from the “outside” by using non-material samples (photons) to observe proto-stellar disks and exoplanetary systems. They use these observations to constrain ideas about planetary system. Since “insiders” and “outsiders” bring crucial insights to the question of star formation and proto-planetary disk formation, a dialog between these communities is important.

This book may aid that dialog by helping “insiders” understand what “outsiders” are up to. It provides an introduction to nearly all aspects of star formation and protoplanetary disk evolution. While the number of topics addressed in the book is large, the concept of accretion provides an organizing theme of the book. These accretions processes are treated in chapters ranging from accretion of interstellar dust and gas into molecular clouds, to collapse of protostellar clouds and accretion of mass onto the protostar, disk accretion, and finally, very briefly, to planet formation. Individual chapters generally begin by providing simple physical arguments or mathematical models for understanding each process. The author then reviews astronomical observations that test those simple ideas or discusses more complicated computer models that describe the physical system more realistically. In some cases, the simple ideas hold up well. More often, and not surprisingly, the models are too simple and do not capture the complexity of star formation. In these cases, the author frequently speculates in interesting ways on how future work may help resolve the conflict between models and observations.

“Insiders” are likely to find the chapters on the physics of proto-planetary disks most relevant to their own work. Nevertheless, the chapters on molecular clouds and protostellar collapse can help provide context for understanding the Sun’s birth. These chapters also provide insight into astronomical questions the meteoritics and planetary science community will probably find useful, or at least interesting, such as the provenance of the initial mass function (the frequency with which stars of a particular mass are born), the origin of binary or multiple star systems, or the overall efficiency of star formation.

This is not a book to be read causally—it will require some study. It will also be most helpful to readers with a good knowledge of basic astronomy and calculus and of advanced undergraduate or even graduate-level physics. There are brief appendices on basic hydrodynamics, magnetohydrodynamics, and radiative transfer; however, most readers who have not studied these topics will probably get bogged down in the arguments using these ideas. My guess is that many “insiders” seeking to understand what “outsiders” are up to will want to turn to a more elementary astrophysics text first or at least have that more elementary text on hand as they work through this book. Readers with the background to appreciate the mathematical and astrophysical arguments the author presents will find this text a valuable review of current thinking on star formation and proto-stellar disk evolution.

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