

# Preface to the Second Edition

Half a decade after the first publication of *From Dust to Stars* there has been rapid and enormous progress in the field of stellar formation and evolution warranting a second edition. After a first review it became clear that the vast majority of the materials covered in the first edition remain very much valid; however, the need for many updates and extensions became obvious. In that respect the basic structure and content of the book has remained intact and existing chapters have received updates at various levels necessary. Three chapters have been added covering multiplicity in star formation (Chapter 7), massive star formation (Chapter 9), and a summary on the detection of exoplanets and basic planet formation (Chapter 13). Two chapters have received major additions, others just updates and minor revisions. The overall changes in the framework of the publication also suggested a switch in title to *The Formation and Early Evolution of Stars* with the subtitle *From Dust to Stars and Planets* to also acknowledge the extension towards planet formation.

Chapter 3 on interstellar matter now treats some basic physics about heating and cooling processes, cosmic rays, and radiative properties of dust. The issue of the mass functions also has a first discussion in that chapter, but it will re-surface at various occasions throughout the book as it now has become a central topic in the field. One may also wonder why there is a distinction of the initial mass function in general and a cluster mass function, which many studies claim to be the same, but after a review of all the material, the jury is still out on that issue. The chapter also received a much-needed extension to a discussion of star formation rates in the Milky Way, in the Local Group, and on cosmological scales.

Chapters 4, 5 and 6 have received only minor updates which might come to many as a surprise, given the enormous amount of material that has been provided through the five years of cold *Spitzer* operations, through the continuation of *HST* and *Chandra*, and now with the availability of *Herschel*. However, for these three chapters, the fundamentals have not really changed and here some updates and selected references to these new studies seemed to suffice. Much of this material has made its way into the book in later chapters.

The first new chapter (Chapter 7) has fixed a major shortcoming of the first edition which did not include much on multiplicity in star formation.

While theory yet has to explain binary formation on most observed scales, concepts of fragmentation which support multiplicity have been developed. Clearly the observational account is present and is currently the focus of many studies.

Chapter 8 again deals with basic physical phenomena in star formation and here only a few additions have been made to complement existing topics such as the *layered accretion* model recognizing that a lot of current research on accretion has moved toward the evolution of proto-planetary systems. The chapter has also remained relevant primarily for low-mass star formation as the following Chapter 9 has now added more topics related to massive stars. Massive star formation has been one of the most relevant topics in the field for the last decade and, at the time the first edition was published, too much was still in flow for a reliable summary. The second edition now fills this void with a review covering the formation of massive stars over a wide range of issues from a description of various observed early stages to massive star formation concepts, to ideas about the formation of the first stars.

Chapter 10 now describes the contribution of X-ray astronomy and here updates also have been extensive. The topic more than ever deserves its own chapter as this wavelength band is still widely ignored by many in star formation research. And yet the contributions, specifically with the big observatories *Chandra* and *XMM-Newton* still available to the community, are growing. What is also acknowledged more than ever is the fact that high-energy radiation plays a crucial role in the transformation of gas accretion to planet-forming disks. The accounts of active star forming regions are growing and so is the notion that it is never a single era event but it happens hierarchically where regions of collapsing stars are embedded in regions that are already actively forming planets. Here the *Chandra Carina Complex Project* proves to be an instructive study.

Extensive surveys by *Spitzer* such as *GLIMPSE* or the legacy program *Core to Disk* contribute vastly to our understanding of the evolution of protoplanetary nebulae and on several occasions there are references to these programs. In the first edition the transition from accretion towards planet formation has only been presented as an investigation of the Sun's origins and this is now Chapter 12. The discovery of so many exoplanets from the ground and now of even more from space with *Kepler* has led to increased efforts in the community, not only to search for planets but, to study the formation and early evolution of planetary systems. Chapter 13 thus has been added to provide a most actual account of exoplanetary research and provide some basic introduction into the formation of terrestrial and giant planets.

To reiterate what has been emphasized in the preface to the first edition for this second edition, the book includes the contributions of many scientists and the reference list grew to over 1,300 entries. And again many have helped me in the form of discussions, presentations, and reviews. My thanks for the first edition also extend to this second edition. Specific thanks go to M. Krumholz (Santa Cruz), J. H. Kastner (RIT), J. Winn, and P. Ford (both MIT) for scientific advice on the new extended material, and best of all for pointing out most recent developments I was not yet aware of. Much appreciation also goes to G. Allen and my fiancée Erin for very helpful proof-reading, N. Shen for her efforts on the bibliography, and

to Springer for valuable comments to improve on the overall content. Final thanks go to Clive Horwood, whom I wish a happy life after retirement, and John Mason for getting this second edition going, and Ramon Khanna for managing its placement into Springer's Astronomy and Astrophysics library.

This revision also is very environmentally friendly owing to the use of modern cinema screen technology – most of the material and revised sections could be reviewed on screen and were pretty much paper- and toner-less. In fact, the only paper print of this manuscript came into existence for the copy-edit process at the very end of the process. All of the referred manuscripts were read and stored electronically saving many precious trees.

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