World Scientific Series in Astrophysics

Mark R Krumholz

Star Formation

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Mark R Krumholz
Australian National University, Australia

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Published by

World Scientific Publishing Co. Pte. Ltd.

5 Toh Tuck Link, Singapore 596224

USA office: 27 Warren Street, Suite 401-402, Hackensack, NJ 07601

UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

Library of Congress Cataloging-in-Publication Data

Names: Krumholz, Mark R., author.

Title: Star formation / Mark R. Krumholz (Australian National University, Australia).

Description: Hackensack, NJ : World Scientific, 2017. | Series: World Scientific series in astrophysics | Includes bibliographical references and index.

Identifiers: LCCN 2016041683| ISBN 9789813142022 (hard cover ; alk. paper) | ISBN 9813142022 (hard cover ; alk. paper) | ISBN 9789813142039 (pbk ; alk. paper) | ISBN 9813142030 (pbk ; alk. paper)

Subjects: LCSH: Stars--Formation.

Classification: LCC QB806 .K78 2017 | DDC 523.8/8--dc23

LC record available at https://lccn.loc.gov/2016041683

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library.

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Desk Editor: Ng Kah Fee

Typeset by Stallion Press

Email: enquiries@stallionpress.com

Printed in Singapore by Mainland Press Pte Ltd.

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Series Editor: Amiel Sternberg (*Tel Aviv University, Israel*)

Published

Star Formation
by Mark R Krumholz (Australian National University, Australia)

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Dedicated to my family, Barbara, Alan, Ethan, and Rebecca, and with thanks to my students, who have contributed tremendously to the development of this book.

Preface

This book is based on a series of lectures given by the author in his graduate class on star formation, taught from 2009–2016 at the University of California, Santa Cruz and Australian National University. It is intended for graduate students or advanced undergraduates in astronomy or physics, but does not presume detailed knowledge of particular areas of astrophysics (e.g., the interstellar medium or galactic structure). It is intended to provide a general overview of the field of star formation, at a level that would enable a student to begin independent research in the area.

This course covers the basics of star formation, ending at the transition to planet formation. The first two chapters, comprising part I, begin with a discussion of observational techniques, and the basic phenomenology they reveal. The goal is to familiarize students with the basic techniques that will be used throughout, and to provide a common vocabulary for the rest of the course. The next five chapters form part II, and provide a similar review of the basic physical processes that are important for star formation. Part III includes all the remaining chapters. These discuss star formation over a variety of scales, starting with the galactic scale and working our way down to the scales of individual stars and their disks, with slight deviations to discuss the particular problems of the formation of massive stars and of the first stars. The book concludes with the clearing of disks and the transition to planet formation.

The "texts" intended to go with these notes are the review articles "The Big Problems in Star Formation: the Star Formation Rate, Stellar Clustering, and the Initial Mass Function", Krumholz, M. R., 2014, *Physics Reports*, 539, 49, which provides a snapshot of the theoretical literature, and "Star Formation in the Milky Way and Nearby Galaxies", Kennicutt, R. C., & Evans, N. J., 2012, *Annual Reviews of Astronomy & Astrophysics*, 50, 531, which is more focused on observations. Another extremely useful reference is the series of review chapters from the Protostars and Planets VI Conference, which took place in July 2013. Suggested background readings to accompany most chapters are listed at the chapter beginning. In addition to these background materials, most chapters also include "suggested literature": papers from the recent literature whose content is relevant to the material covered in that chapter. These readings are included to help students engage with the active research literature, as well as the more general reviews.

In addition to the text and reading, this book contains five problem sets, which are interspersed with the chapters at appropriate locations. Solutions to the problems are included as an Appendix.

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