

Cambridge University Press
978-0-521-87998-9 - The Metal-Rich Universe
Edited by Garik Israelian and Georges Meynet
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THE METAL-RICH UNIVERSE

Metal-rich stars accumulate their metals from previous generations of stars, and so they contain the history of their galaxy. By studying these stars we can gain valuable insights into how metals change the formation and evolution of stars, and why giant exoplanets seem to be found around metal-rich stars, and explain the extraordinary massive-star populations observed in the metal-rich region of our own galaxy.

Until now this topic has received much less attention than very metal-poor stars, which give clues to the early chemical evolution of galaxies. Recent observations of metal-rich regions have shown that stars hosting giant planets are generally metal-rich, which has triggered further observations of metal-rich stars. This has led to the discovery of new exoplanets, and advances in the study of planet formation and the late chemical evolution of galaxies.

This book is the first on this topic, and it covers many aspects, from spectral-line formation to stellar formation and evolution in high-metallicity regimes. It is invaluable to researchers and graduate students in stellar evolution, extragalactic astronomy, and planet formation.

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CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo, Delhi
Cambridge University Press
The Edinburgh Building, Cambridge CB2 8RU, UK
Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on the title www.cambridge.org/9780521879989

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First published 2008

Printed in the United Kingdom at the University Press, Cambridge

A catalogue record for this publication is available from the British Library

ISBN 978-0-521-87998-9 hardback

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Preface

Even though metals constitute only a few per cent of the total mass fraction of stars, they have a huge impact on the way stars and galaxies evolve. In that respect, metallicity in the Universe is, like the salt in a dish, a small amount that can completely change its flavour!

The metal-rich stars have never attracted as much attention as the metal-poor halo stars, which tell us about the first supernovae and the early chemical evolution of our Galaxy. However, metal-rich stars are of interest in their own right and can shed new lights on very topical subjects. For instance, it is now well established that stars rich in metals are more likely to harbour giant planets. This awareness has elicited careful and detailed abundance studies of ever more metal-rich stars. As a byproduct, trends of the abundances of many elements at high metallicity are now available and await an interpretation in terms of stellar nucleosynthesis and chemical-evolution models. The extent to which these observed trends are in line with what is expected from the current stellar and chemical-evolution models largely remains to be checked and this is one of the main topics of these proceedings.

Putting the subject into a larger context, let us recall that the attainment of adequate models of the high-metallicity regime is of great interest for the study of the central regions of galaxies, which are thought to have higher-than-solar metallicity. Also, it appears that many quasar environments are metal-rich out to redshifts of at least 5. A better knowledge of star formation and evolution in central regions of galaxies would thus appear crucial to enhancing our understanding of these fascinating objects.

In these proceedings, the reader will find the latest observations of metal-rich stars (in the field, clusters, bulge, planet hosts, etc.), as well as presentations of models of atmospheres and spectral-line formation, models of stellar evolution

and nucleosynthesis at high $[\text{Fe}/\text{H}]$, discussions on the contribution of metal-rich stars to nucleosynthesis, and models for the chemical evolution of galaxies in the high-metallicity regime.

Many very interesting questions are addressed, for instance the following.

How do stars form in metal-rich regions?

What can be said on the possible variation of the initial mass function at high metallicity?

Is the upper mass limit lower at higher metallicity?

Is high metallicity a necessary condition for planet formation around stars?

Is there a minimum metallicity for planets to form around stars?

How different is the evolution of stars with higher-than-solar metallicity from that of their solar-metallicity counterparts?

What are the consequences for the stellar populations expected and the chemical enrichment of the interstellar medium?

About 100 participants from 19 countries took part and, it is hoped, enjoyed the week they spent in La Palma. Their written contributions contained in the present book will help to make the metal-rich Universe a topical subject for the next few years. Some of the figures communicate little or no information in black and white, so they have been made available in colour on the book's website.

This conference could be organised thanks to the financial help of Cabildo Insular de La Palma, Patronato de turismo de La Palma, DISA Corporacion Petrolifera S.A. and Banco Bilbao Vizcaya Argentaria.

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Our warmest thanks go to Judith de Araoz for her efficient work in managing the secretary's office before, during and after the conference.

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