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978-0-521-77058-3 - Globular Clusters: X Canary Islands Winter School of Astrophysics

Edited by C. Martinez Roger, I. Perez Fournon and F. Sanchez

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Globular clusters are spherical, densely packed groups of stars found around galaxies. They are thought to have formed at the same time as their host galaxy and thus provide a powerful probe for understanding stellar and galaxy evolution, as well as being studied as objects of interest in their own right. This timely volume presents invited articles by a team of world leaders who gathered at the X Canary Islands Winter School of Astrophysics to review our current understanding of globular clusters. It provides an accessible introduction to the field for graduate students and a comprehensive and up-to-date reference for researchers.

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This volume is dedicated to the memory of
Rebecca Elson,
who died tragically on May 19, 1999.

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X Canary Islands Winter School of Astrophysics

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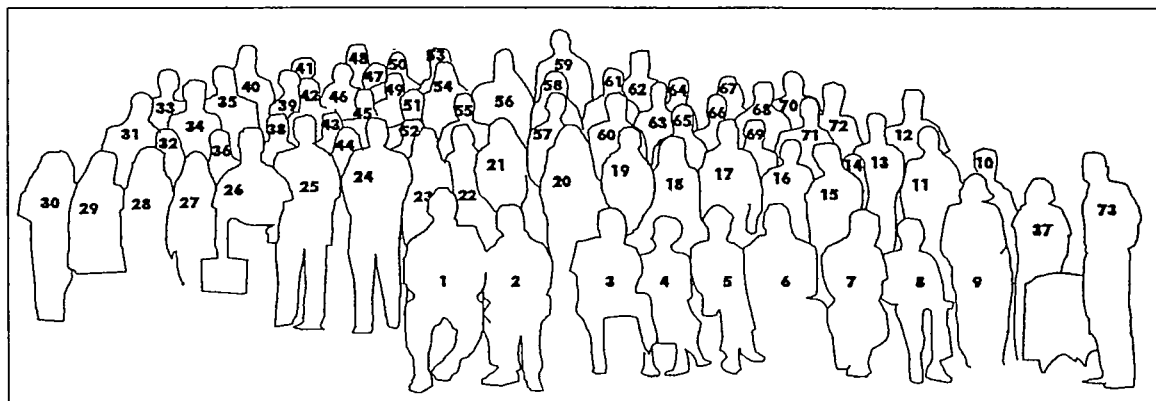


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Preface

The study of globular clusters has been and still is essential for furthering our knowledge of such astrophysical phenomena as stellar and galactic evolution, variable and X-ray emission stars, chemical abundances (primordial nucleosynthesis), etc. Globular clusters are ideal laboratories for testing theories of stellar evolution, the chemical evolution of the Universe and the dynamics of N-body systems. They are the oldest known objects whose ages can be independently determined, the closest in proximity to the origin of the Universe and the sole surviving structures of the first stages in the formation of the Galaxy. They provide us with important evidence concerning on the age and formation processes of the Galaxy. Globular Clusters are a fundamental unit of the known Universe, they are also found in all other galaxies within our observational grasp. They are possibly a necessary stage in the formation of galaxies.

Research on Globular Clusters covers a vast amount of territory that was reviewed and collected in the present book. From the photographic plate to the HST most recent results, the field of Globular Clusters was actualised and presented by Ivan R. King, with an interesting Observational Approach to Populations in Globular Clusters, where discusses the observations on which our understanding of globular clusters lies. Steven Majewski, reviews the Stellar Populations and Formation of the Milky Way, with particular emphasis on the role of globular clusters in tracing stellar populations and unravelling the Galactic history. Vittorio Castellani in Globular Clusters as test Stellar evolution, reviews the theoretical predictions concerning the evolution of old, metal-poor stars in galactic globulars, in the light of recent improvements of the input physics. Raffaele Gratton, reviews the Early nucleosynthesis and chemical abundances of stars, where presents a self consistent sketch of current understanding in the topic. Rebecca A.W. Elson, on the Stellar Dynamics, provides an overview of the life of a globular cluster and presents some recent results from a large HST project to study the formation and evolution of rich star clusters in the Large Magellanic cloud. Michael W. Feast, reviews the scenario of the Pulsating stars and their use. Ramón Canal begin his chapter with the formation mechanism of neutron stars and end by discussing about the origin and evolution of x-ray sources and millisecond pulsars in globular clusters. Finally William E. Harris, reviews and actualises the scenario of Globular Clusters Systems, from the Milky way globulars and thorough the study of a few case individual galaxies show the richness and diversity of this field.

As scientific research becomes ever more highly specialised, researchers, particularly those who are now beginning their careers in this atmosphere of intense specialisation, are finding it harder and harder to keep abreast and properly orientated in all the disciplines related to their line of work. The X Winter School of Astrophysics of the Instituto de Astrofísica de Canarias and this book, was planned with a view to offering a thorough review of research on Globular Clusters and is intended to cover all the relevant disciplines with the aid of the best possible international team of specialists, including the theoretical and observational aspects of stellar populations.

This book collects an up-to-date overview of the Globular Cluster field, in order to gain clearer insight into the “big picture”, and to help experts link their own field to its surroundings while improving their understanding of their own works. With regard to the young researcher we seek to install in them an awareness of the “great game of investigation” enjoyed by their more experienced peers. This aspect of the book will

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ensure that it plays a twofold role in the fields of education and training, as well as becoming a vehicle for the dissemination of the latest findings.

Carlos Martínez Roger
Instituto de Astrofísica de Canarias
January 1999

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Foreword

For a decade now, the Instituto de Astrofísica de Canarias (IAC) has hosted the Canary Islands Winter School of Astrophysics in which young astrophysicists from all over the world have the opportunity of meeting accredited specialists to study the topics of most active concern in present-day astronomy. During these ten years 80 lecturers and more than 600 students have attended the Winter School, an even higher number not being able to come due to the limited number of places available.

The X Canary Islands Winter School on Astrophysics was dedicated to Globular Clusters, one of the basic sources of our knowledge concerning the lives of the stars and the physics of their evolution.

The School intended to portray a thorough review of research in this field, covering all the relevant disciplines with the aid of the best possible international team of specialists (Canada, Italy, South Africa, Spain, the United Kingdom and the United States), including the theoretical and observational aspects of stellar populations, stellar evolution and chemical abundances, dynamics, variable stars, X-ray sources and the globular clusters of other galaxies.

We take the opportunity to thank local Canarian authorities - Cabildo Insular de La Palma, and Cabildo Insular de Tenerife, as well as the Town Hall of La Laguna, for their continuous support during this and also previous editions of the School.

This tenth Winter School marks a milestone on a long but gratifying journey, in spite of occasional difficulties. I am confident that the next ten Winter Schools will be equally enriching and beneficial for all that take part.

Francisco Sánchez Martínez
Director of the Instituto de Astrofísica de Canarias

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IVAN R. KING was born in New York in 1927.

He studied at Harvard University, where he obtained his doctorate in 1952.

He then worked as a mathematician for a private firm, as an instructor for Harvard University (1951-52) and, during the following four years was attached on Active Duty to the US Naval Reserve and the Department of Defense (1954-56) as a methods analyst.

From then onwards, his career followed a more academic line: professor of the University of Illinois from 1956 to 1964, and Professor of the University of California Berkeley, where he occupied a chair from 1966 to 1992 and where he is a present Emeritus Professor. King has served as President of the Dynamical Astronomy Division of American Astronomical Society and of the Astronomy Section of the American Association for the Advancement of Science (1973-1974). He was elected member of the American Academy of Arts and Sciences in 1980 and of the National Academy of Science in 1982.