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978-0-521-63255-3 - Stellar Astrophysics for the Local Group: VIII

Canary Islands Winter School of Astrophysics

Edited by A. Aparicio, A. Herrero and F. Sánchez

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With the recent advent of large, ground-based telescopes and space telescopes, it is now possible to study in detail stars outside our galaxy – in neighbouring galaxies in the so-called Local Group. The VIII Canary Islands Winter School of Astrophysics gathered leading experts from around the world to review this exciting new area of research – extragalactic stellar astrophysics. This volume presents eight specially written articles based on the meeting, reviewing how the study of stars in nearby galaxies can be used to understand stellar and galactic structure and evolution in general.

This book covers all aspects of extragalactic stellar astrophysics: stellar physics, stellar winds, stellar evolution, the use of photometric and spectroscopic techniques for studying extragalactic stars, stellar populations, chemical evolution, star formation histories and the calibration of the extragalactic distance scale.

This timely volume provides graduate students and researchers with an invaluable introduction to and reference on the new subject of extragalactic stellar astrophysics.

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**CAMBRIDGE CONTEMPORARY ASTROPHYSICS**

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# Stellar Astrophysics for the Local Group

VIII Canary Islands Winter School of Astrophysics

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 Frontmatter  
[More information](#)

## Contents

<i>Participants</i>	x
<i>Preface</i>	xiii
<i>Acknowledgements</i>	xv

### Fundamentals of Stellar Evolution Theory: Understanding the HRD

*C. Chiosi*

Introduction . . . . .	1
Basic stellar evolution . . . . .	2
Physical causes of violent ignition, explosion, and collapse . . . . .	11
Two basic ingredients: nuclear reactions and opacities . . . . .	16
Stellar winds: observational and theoretical hints . . . . .	18
Classical evolution of massive stars with mass loss . . . . .	24
Convection: the major uncertainty . . . . .	32
Passing from theory to observations . . . . .	47
Globular clusters . . . . .	51
Old open clusters . . . . .	61
Young rich clusters of the LMC . . . . .	62
The HRD of supergiants stars: open problems . . . . .	63
Modelling AGB & Carbon stars: recent results . . . . .	72
Cepheid stars: mass discrepancy and mixing . . . . .	76
References . . . . .	79

### Observations of the Most Luminous Stars in Local Group Galaxies

*P. Massey*

Introduction . . . . .	95
Introducing the unevolved luminous stars . . . . .	98
Finding main-sequence luminous stars in the Local Group: methodology for a hard problem . . . . .	108
Finding the evolved descendants of massive stars: LBVs, WRs, and RSGs . . . . .	116
Secrets of star formation as revealed by luminous stars . . . . .	124
Secrets of stellar evolution revealed by luminous stars . . . . .	130
Summary: what to take away from all this . . . . .	144
References . . . . .	145

### Quantitative Spectroscopy of the Brightest Blue Supergiant Stars in Galaxies

*R.P. Kudritzki*

Introduction . . . . .	149
Atmospheres of luminous hot stars . . . . .	158
Methods of spectral diagnostics . . . . .	177
The X-ray emission of O-stars . . . . .	195
IR - diagnostics of blue supergiants with extreme mass-loss . . . . .	201
The most massive stars in the Local Group . . . . .	213
Stellar abundances in Local Group galaxies and beyond . . . . .	214
The Wind Momentum - Luminosity Relationship and extragalactic distances . . . . .	232

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 Canary Islands Winter School of Astrophysics  
 Edited by A. Aparicio, A. Herrero and F. Sánchez  
 Frontmatter  
[More information](#)

viii

Contents

Extragalactic stellar astronomy - a vision . . . . .	254
Appendix A. Oscillator strengths distribution function of hydrogen . . . . .	256
References . . . . .	256

## Calibration of the Extragalactic Distance Scale

*B.F. Madore & W.L. Freedman*

Introduction to the lectures . . . . .	263
Cepheids . . . . .	264
Brief summary of the observed properties of cepheid variables . . . . .	266
Simple physical considerations . . . . .	267
Observational considerations . . . . .	271
Advances driven by new technology . . . . .	275
CCDs and multiwavelength coverage . . . . .	277
Obtaining accurate cepheid distances . . . . .	278
Local Group galaxies . . . . .	280
Beyond the Local Group . . . . .	283
The Hubble constant . . . . .	288
The future . . . . .	288
Contrasting aspects of the PL and PLC . . . . .	289
A reddening-free formulation of the PL relation . . . . .	291
Comments on reddening determinations . . . . .	295
Comparisons with other distance indicators . . . . .	299
The key project . . . . .	300
Other ground-based work . . . . .	303
Helium core flash and the tip of the red giant branch as a primary distance indicator . . . . .	305
The ideal distance indicator . . . . .	305
Some history concerning the red giant branch . . . . .	306
Concerns and technical issues . . . . .	309
An overview of the theoretical underpinnings: core helium ignition . . . . .	312
Recent applications of the TRGB method . . . . .	313
The scorecard . . . . .	315
Discussion . . . . .	318
Implications of the Hipparcos observations of galactic Cepheids . . . . .	319
Comparison with V-band period–luminosity relations . . . . .	319
Multiwavelength period–luminosity relations . . . . .	320
Discussion . . . . .	324
Implications of a cepheid distance to the Fornax cluster . . . . .	327
NGC 1365 and the Fornax cluster . . . . .	328
HST observations . . . . .	329
Cepheids in NGC 1365 . . . . .	330
The Hubble constant . . . . .	331
The Hubble constant at Fornax . . . . .	333
The nearby flow field . . . . .	334
Beyond Fornax: the Tully-Fisher relation . . . . .	336
Beyond Fornax: other relative distance determinations . . . . .	338
Beyond Fornax: type Ia supernovae . . . . .	339
Cosmological implications . . . . .	340
Conclusions . . . . .	341
References . . . . .	343



## Dwarf Galaxies

*G.S. Da Costa*

Introduction . . . . .	351
Prelude: results from standard stellar evolution . . . . .	352
“Old” populations in the Magellanic Clouds . . . . .	358
Local Group dE and dSph galaxies . . . . .	363
Local Group dIrr galaxies . . . . .	388
Dwarf galaxies beyond the Local Group . . . . .	396
Summary . . . . .	401
References . . . . .	402

## Resolved Stellar Populations of the Luminous Galaxies in the Local Group

*M. Mateo*

Introduction . . . . .	407
Photometric techniques . . . . .	408
Star clusters in the Local Group . . . . .	415
The old and intermediate-age populations in luminous LG galaxies . . . . .	423
“Young” field star populations in luminous LG galaxies . . . . .	429
Variable star populations in LG galaxies . . . . .	433
Beyond the Local Group . . . . .	438
Epilogue . . . . .	444
Appendix: stellar photometry examples using DoPHOT . . . . .	445
References . . . . .	452

## Chemical Evolution of the ISM in Nearby Galaxies

*E.D. Skillman*

Introduction and purpose . . . . .	457
Abundances from HII regions . . . . .	459
Simple chemical evolution . . . . .	468
Abundance patterns in dwarf galaxies . . . . .	472
Abundance patterns in spiral galaxies . . . . .	489
Self-consistent star formation histories . . . . .	504
Summary . . . . .	518
References . . . . .	518

## Populations of Massive Stars and the Interstellar Medium

*C. Leitherer*

Introduction . . . . .	527
Regions of high-mass star formation . . . . .	528
Massive stars in resolved populations . . . . .	543
Evolutionary synthesis of unresolved high-mass populations . . . . .	556
Release of mass and energy by massive stars . . . . .	569
Massive stars and the dynamics of the ISM . . . . .	585
References . . . . .	598

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[More information](#)

---

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xi

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## Preface

The goal of the Canary Islands Winter School of Astrophysics, organized by the Instituto de Astrofísica de Canarias (IAC), is to bring together each year advanced graduate students, recent postdocs and interested scientists with a group of leading experts in a particular area of astrophysics. The one held in 1996 in La Laguna (Tenerife, Spain) was devoted to the stellar content of the Local Group and the application of its study to more distant galaxies.

The idea of using the Local Group as a typical case and as a first step towards understanding the more distant Universe has its origins in the possibility of arriving at a detailed knowledge of the properties of its constituent galaxies and their stars. We are still making progress in acquiring a detailed knowledge of the Local Group, but we realize that the unknowns far outweigh the knowns, and this is precisely the reason why study of the Local Group is still, and will continue to be, useful. As the results from the Hubble Space Telescope are coming in, we are witnessing a rapid advance in terms of quantity of information. What only a few years ago was no more than vague, often erroneous, conjecture concerning the properties of the nearest galaxies is now becoming irrefutable evidence, which in its turn raises new questions on aspects that were previously beyond our grasp. This change currently under way has also been aided by large ground-based telescopes, such as the WHT on La Palma, and especially the Keck I and II telescopes on Hawaii, and will be reinforced by the new technological achievements represented by the new generation of 8-10 m telescopes (from the VLT to the 10 m GTC, and the LBT, Gemini, Subaru, HET, etc., in between), together with rapid advances in detector size and sensitivity.

This is therefore a fitting moment to review what we know and do not know about the Local Group, to recognize our present limitations and identify areas where we might begin to glimpse an answer.

Why stellar astrophysics? Stars are born from the gaseous medium of galaxies; they evolve in a manner which depends mainly on their mass and eventually they die, returning part of their constituent material to the gaseous medium from which they came; but this material now has a different composition and dynamics. This irreversible process is the main driver of the evolution of most galaxies. If we knew how many stars of each age and chemical composition a galaxy has (i.e., its star formation history), we could, by making use of what we know concerning the processes that affect stars, understand what the galaxy is really like and how it evolves. What we manage to unravel concerning the conditions and the way in which stars are formed, the details of their evolution and the processed material which they return to the interstellar medium, will drive our knowledge of galaxies.

One of the most important applications of extragalactic stellar observations is the measurement of distances in the Universe. The Cepheids provide one of the standard measuring rods that enable us to construct a cosmic distance scale. This standard distance candle has to be continuously reviewed and updated, and great efforts are dedicated to the refinement of this method. But progress continues, and new techniques appear that may complement the Cepheid method. The *wind momentum–luminosity relation*, whose fundamentals are explained in chapter 3, is one of them.

For a long time, many classical applications of observations of stars, such as studies of ages and populations, stellar evolution, abundances, detailed interaction with the surrounding medium, etc., were limited by the faintness of extragalactic stars. At the same time, it was known that galaxies different from the Milky Way offered different conditions for stellar formation and evolution so that including them in studies already

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---

xiv

## Preface

carried out on our Galaxy would permit a significant advance in our understanding of these fields. At present, the technological developments referred to above are overcoming many of these difficulties, and a new era of stellar astrophysics may soon open up for us.

This whole conjunction of positive aspects encouraged us to suggest the topic of this book and to work enthusiastically towards bringing about the meeting. Trying to find the best list of topics and the best people to teach and review them, we brought together eight specialists in various aspects of the problem, which range from stellar evolution to stellar population synthesis as applied to distant galaxies; from the physics of stellar atmospheres to the properties of galaxies and the interstellar medium and the extragalactic distance scale.

We have no doubt that all the effort involved has greatly benefited all the participants, and we would like to extend this experience to all who are interested through the publication of these proceedings.

Artemio Herrero, Antonio Aparicio  
*La Laguna, Tenerife*  
*Noviembre, 1997*

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