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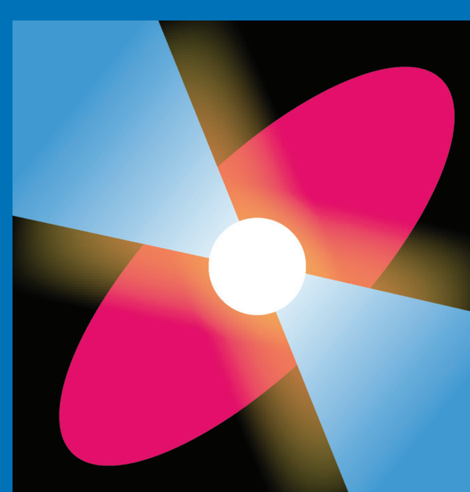
272

19-23 July 2010,
Paris, France

Active OB Stars: Structure, Evolution, Mass-Loss, and Critical Limits

Edited by

Coralie Neiner
Gregg Wade
Georges Meynet
Geraldine Peters



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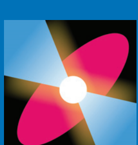

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ACTIVE OB STARS: STRUCTURE, EVOLUTION, MASS-LOSS, AND CRITICAL LIMITS

PROCEEDINGS OF THE 272th SYMPOSIUM OF THE INTERNATIONAL ASTRONOMICAL UNION HELD IN PARIS, FRANCE JULY 19–23, 2010

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Table of Contents

Part 1. OPENING THE SYMPOSIUM

Part 2. RAPID ROTATION AND MIXING IN ACTIVE OB STARS

Section A. Review and contributed talks

Chairs: Georges Meynet and Geraldine Peters

https://doi.org/10.1017/S1743921311012312 Published online by Cambridge University Press

Section B. Posters

Part 3. WINDS AND MAGNETIC FIELDS OF ACTIVE OB STARS

Section A. Review and contributed talks

Chairs: Jean-Claude Bouret and Lydia Cidale

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Section B. Posters

Part 4. POPULATIONS OF OB STARS IN GALAXIES

Section A. Review and contributed talks

Chairs: Hideyuki Saio and Gregg Wade

Section B. Posters

https://doi.org/10.1017/S1743921311012312 Published online by Cambridge University Press

Part 5. CIRCUMSTELLAR ENVIRONMENT OF ACTIVE OB STARS

Section A. Review and contributed talks

Chairs: Douglas Gies and Richard Townsend

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Section B. Posters

https://doi.org/10.1017/S1743921311012312 Published online by Cambridge University Press

Part 6. PERIODIC VARIATIONS AND ASTEROSEISMOLOGY OF OB STARS

Section A. Review and contributed talks

Chairs: Juan Fabregat and Thomas Rivinius

Section B. Posters

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Part 7. 'NORMAL' AND ACTIVE OB STARS AS EXTREME CONDITION TEST BEDS

Section A. Review and contributed talks

Chairs: Marc Gagné and Eduardo Janot Pacheco

Section B. Posters

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Part 8. LAST MINUTE CONTRIBUTION

Part 9. CLOSING THE SYMPOSIUM

Preface

Early-type (OB) stars dominate the ecology of the universe as cosmic engines via their extreme output of radiation and matter, not only as supernovae but also during their entire lifetime with far-reaching consequences. Active OB stars are massive and intermediate-mass stars that display strong variability on various time scales due to such phenomena as mass outflows, rapid rotation, pulsations, magnetism, binarity, radiative instabilities, and the influence of their circumstellar environment. This concerns in particular classical and Herbig Be, Bp, β Cep, Slowly Pulsating B Stars (SPB), B[e] and O stars, as well as massive binaries such as the Be X-ray binaries and those that harbor O-type subdwarf companions.

Research in the domain of active OB stars has been progressing very rapidly in the last decade and is entering a new era thanks to the advent of new space and ground-based instrumentation. Space asteroseismology (MOST, CoRoT, Kepler) allows us to study the internal structure of massive stars and their rotation; efficient high-resolution spectropolarimetry (Narval, Espadons) provides clues about magnetic fields and the confinement of the circumstellar environment; interferometry (e.g. VLTI, CHARA) allows us to probe the shape of these environments and investigate differential rotation; multi-object spectroscopy on very large telescopes (e.g. Giraffe@VLT) allows us to study the effects of stellar environment and evolution on the active OB stars and provides information on the distribution of surface velocities and abundances; large galactic surveys (e.g. IPHAS, INTEGRAL) allow the detection of large numbers of emission line objects and massive X-ray binaries with great potential for studies of galactic structure. Active OB stars studies have also taken a leap forward thanks to state-of-the-art modeling (Monte-Carlo radiative transfer, asteroseismic models, models of magnetospheres, and disk models, including rapid rotation effects, multi-dimensional calculations). Moreover, massive stars are inherently extreme objects, in terms of rotation, mass loss, radiation fields and in some cases magnetic fields, and thus can serve as testbeds for extreme conditions. From a theoretical viewpoint, this is likely to be important for understanding the first massive star generations in the universe and will provide strong clues on the physics of fast rotation, which is a key ingredient in many current models such as the collapsars model to explain the long soft Gamma Ray Bursts. Alternatively, B stars have historically provided the astronomical community with the best calibrations of fundamental parameters for upper main sequence stars (e.g. $T_{\rm eff}$, $\log g$, masses, radii, chemical composition). Since activity of various types is commonplace in the B stars it is important to assess the uncertainty in the parameters of upper main sequence stars that results from the presence of stellar activity.

The major progress currently obtained in the field of active OB stars will thus help to answer long-standing as well as new questions such as:

- What is the role of magnetic field, rotation, metallicity and mass loss in the evolution of OB stars? In particular, how does it influence their late stages (neutron stars, black holes, GRBs)? How do surface abundances evolve?
- What is the role of magnetic fields, rotation, and pulsations in the activity of OB stars, in particular on their circumstellar environment? What is responsible for wind clumping and the formation of a disk (Be phenomenon) or clouds?
- What is the internal structure of active and near-critically rotating OB stars? How is the angular momentum transported? Is there a magnetic field, and is it of fossil or dynamo origin?

• Under what conditions do active OB stars become Be stars? What causes LBV outbursts? What happens when a star reaches critical rotational velocity?

• What are the statistical properties of the various populations of OB stars? What is the incidence of magnetic fields? What is the distribution of intrinsic velocities? What are the properties of mass loss?

• How do recent advances in theory and computation of model atmospheres and synthetic spectra, and in the observation of such spectra, make it possible to discover and study new and puzzling phenomena in active OB stars and test theoretical models of these phenomena?

In 1999, IAU Colloquium 175 held in Alicante (Spain) concentrated on "The Be Phenomenon in Early-Type Stars". In 2005, an international meeting held in Sapporo (Japan) was dedicated to "Active OB-stars: Laboratories for Stellar and Circumstellar Physics". In 2010 in Paris the IAU Symposium 272 was dedicated to discussion of the structure, evolution, mass loss, and critical limits of early-type stars, four axes of research that are currently providing important clues about the physics of these objects. The meeting allowed fruitful exchange by bringing together scientists working in the fields of O stars, B stars, Bp stars, Be stars and Herbig Be stars, at wavelengths that span the electromagnetic spectrum (especially X-ray, UV, optical, and IR) with emphasis on forefront observational techniques (e.g. spectropolarimetry, interferometry, asteroseismology). The meeting thus resulted in further important progress in our understanding of active OB stars and gave rise to new projects that will be undertaken in the second decade of the 21st century.

The key topics of the IAU Symposium 272 were:

• the internal structure of active OB stars: pulsations, rotation, magnetism, transport processes

• their evolution: stellar environment, formation, binaries, late stages (including magnetars and GRBs)

• their circumstellar environment: disks, magnetospheres, the Be phenomenon, wind, clumping

• active OB stars as extreme condition test beds: critical rotation, mass loss, radiation fields

• 'normal' OB stars as calibrators: fundamental parameters, astronomical quantities

• populations of OB stars: population studies, tracers of galactic structure, cosmic history

The IAU Symposium 272 was held in Paris from July 19 to 23, 2010. We acknowledge the financial support of our sponsors listed on page *xxi* of these Proceedings, as well as the very active support of the members of the LOC in preparing the numerous details associated with such a symposium. It is a great pleasure to acknowledge in particular Michèle Floquet, the co-chair of the LOC, for whom this symposium was a "last hurrah" before her retirement.

Coralie Neiner and the SOC members
Meudon, September 12, 2010

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12. Jean Zorec
13.
14. Paula Marchiano
15. Erika Grundstrom
16. Vladimir Strelnitski
17.
18.
19. Rodolfo Vallverdu
20.
21. Joachim Puls
22. Jean-Claude Bouret
23. Artemio Herrero
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25. Christopher Tycner
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29. Bernard Leroy
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32. Paul Dunstall
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34. Cyril Georgy
35. Vitaly Goranskij
36. Virginia McSwain
37. Miriam Garcia
38. Brankica Surlan
39. Fabio Frescura
40. Anahí Granada
41. André Maeder
42. Nancy Remage Evans
43. David Cohen
44. Sylvia Ekstrom
45. Olivier Thizy
46. Viktor Votruba
47. Philip Peters
48. Jose Groh
49. Geraldine Peters
50. Elena Barsukova
51. Selma de Mink
52. Yuuki Moritani
53. Gail Schaefer
54.
55. Olivier Chesneau
56. Robbie Halonen
57. Huib Henrichs
58. Brian Van Soelen
59. Nazhatulshima Ahmad
60. Ashley Ames
61. Véronique Petit
62. John Wisniewski
63. Vincent Duez
64. Mary Oksala
65. Jan Polster
66. Bertrand de Batz
67.
68. Georges Meynet
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71. Wenjin Huang
72. Nicholas Hill

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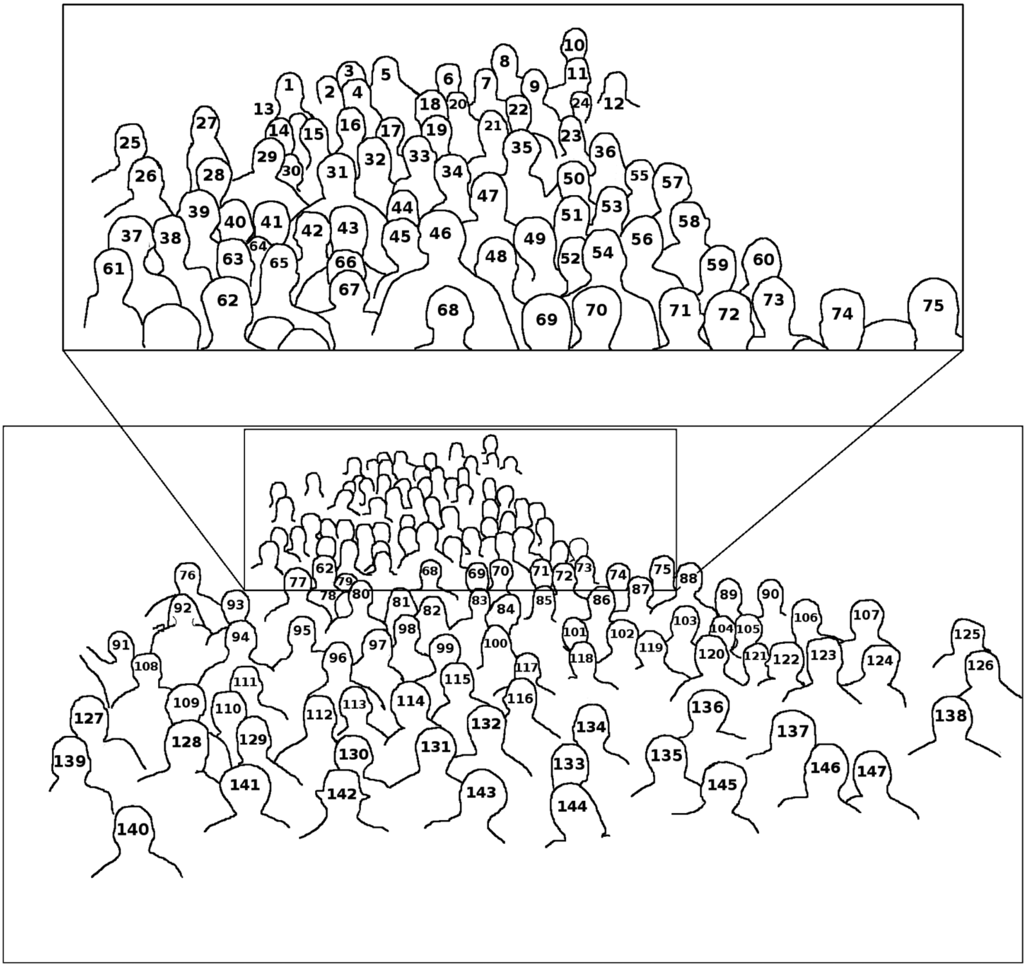

73. Catherine Lovekin
74. Paul KT
75. Francois Cochard
76. Gregg Wade
77. Zachary Draper
78. Rachael Roettenbacher
79. Finny Oktariani
80. Douglas Gies
81. Amber Marsh
82. Carol Jones
83. Chloé Fourtune-Ravard
84. Kostas Markakis
85. Anne-Laure Huat
86. Myron Smith
87. Matteo Cantiello
88. Christopher Russell
89. Kerstin Weis
90. Thomas Rivinius
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92. Coralie Neiner
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94. Vitalii Makaganiuk
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98. Brenda Perez-Rendon
99. Anatoly Miroshnichenko
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108. Gabriela Michalska
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111. Jason Grunhut
112. Matthew Austin
113. Gloria Koenigsberger
114. Derck Massa
115. Atsuo Okazaki
116. René Oudmaijer
117. Delia Volpi
118. Ines Brott
119. Thierry Morel
120. Adrian Potter
121. Beatriz Sabogal
122. Laura Penny
123. Alex Lobel
124. Daniel Lennon
125. Sergio Simon-Diaz
126. Michel Cure
127. Alex Fullerton
128. Thierry Semaan
129. Marc-Antoine Dupret
130. Anne-Marie Hubert
131. Eduardo Janot-Pacheco
132. Alexandre David-Uraz
133. Romain Selier
134. Raman Prinja
135. Alexander Kholtygin
136. André-Nicolas Chené
137. Michelle Edwards
138. Kalju Annuk
139. Aaron Sigut
140. Jonas Debosscher
141. Mohammad Heydari-Malayeri
142. Matthew Shultz
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Address by the Scientific and Local Organizing Committees

Dear colleagues,

It was a pleasure to welcome all of you to the 272dn Symposium of the International Astronomical Union in Paris and to write on behalf of the Scientific and Local Organizing Committees. It has been a long time since our last meetings on active OB stars in Alicante and Sapporo. We hope that, in this new occasion, the symposium fulfilled your expectations, both scientifically and socially. We have counted on very active members of the SOC, who prepared an ambitious scientific programme as well as interactive discussions. Motivated people in the LOC also presented us with a pleasant social programme, and we hope this will also contribute to nice memories of this symposium. I would like to thank in particular the main members of the LOC Evelyne Alecian, Bertrand de Batz, Michèle Floquet and Bernard Leroy, as well as our secretaries Olga Martins and Annick Oger. However, the success of this symposium mostly comes from all of you who contributed in various ways by bringing your knowledge, results, questions, and answers to a fruitful discussion. We thus thank all of you for your participation!

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Thank you very much!

Coralie Neiner, SOC chair and LOC member
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