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Light Elements in the Universe

Light Elements

in the

Universe

Edited by

Corinne Charbonnel

Monica Tosi

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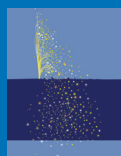
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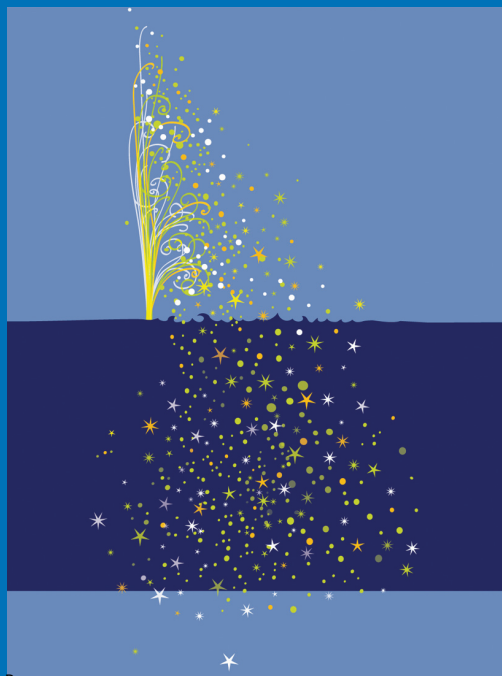


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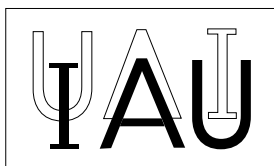
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NOVEMBER 9–13, 2009

Edited by

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Preface

The light elements (H, He, Li, Be, B and their isotopes) deserve special attention because of their relationship with several important astrophysical domains: they provide key clues for stellar and ISM structure and evolution, galaxy formation and evolution, Big Bang nucleosynthesis and cosmology. They are one of the few bridges connecting several different astrophysical communities.

The previous IAU Symposium on the light elements was held in 1999 (in Natal, Brasil, IAU Symp. 198), and other, non-IAU supported, related meetings also took place about a decade ago. Since then, there have been many significant developments both on the observational and theoretical sides. Striking progress was achieved thanks to the accurate determination of the baryon density of the Universe by recent cosmic microwave background experiments. This allowed an unprecedented precision on the determination of the yields of Standard Big Bang Nucleosynthesis and a different perspective in the comparison with the D, ^3He , ^4He and ^7Li abundances measured from observations of low-metallicity environments.

In parallel, the advent of new generation ground and space based telescopes allowed the observation of light elements in objects previously unreachable, with new intriguing results on the present and past abundances of D, He (both ^3He and ^4He), Li and its isotopic ratio, Be and B and their isotopic ratios. Thanks to multi-fiber instruments, a wealth of data could be gathered in a consistent way which still await to be fully understood and interpreted. Also, realistic 3D, time-dependent, hydrodynamical model atmospheres strongly helped in providing more reliable abundance determinations.

On the theoretical side, we entered a golden age for the description of stellar interiors and evolution thanks to improved treatments of stellar rotation, magnetic fields, internal gravity waves, atomic diffusion, and thermohaline instability in new generation stellar models. Most of these improvements were achieved thanks to constraints coming from combined observations of light element abundances in various types of stars. Last but not least, a wealth of independent consistent chemical evolution models able to fit the general trends of the vast majority of Galaxy physical and chemical features were developed that must be tested with respect to the evolution of light elements.

Despite all these achievements, we are far from understanding and reproducing in detail all the light element patterns, their local, short term variations, as well as their global evolution in the Universe. The complete understanding of the evolution of the light elements in the Universe is a challenging task that requires the exchange of ideas and the collaboration of astrophysicists with observational and theoretical expertise in stellar hydrodynamics and evolution, Galactic and extra-galactic astronomy, and cosmology.

We felt that the route to this goal could be found only by gathering specialists in all the different relevant fields in an IAU Symposium. The various IAU Commissions and Divisions corresponding to these research fields have favourably received and endorsed our request, thus making this conference possible. The Symposium brought together 118 participants from 23 countries around the world to discuss the achievements as well as the problems concerning the light elements. We had 25 invited reviews, 53 oral contributions and 35 posters distributed over five sessions.

Several important issues, still highly controversial, have been tackled during the meeting thanks to the collective inputs from observers, stellar and galactic physicists, and cosmologists. To let the participants have time to discuss at length the hottest topics identified by the SOC, we also organized four discussion sessions: one on the dispersion

of the observational D abundances, one on the problems affecting the derivation of ^4He from HII regions, one on the problems affecting the derivation and interpretation of Li, Be and B abundances, and one on the stellar yields of ^3He , ^4He and ^7Li .

In addition to the scientific program, we enjoyed a public conference attended by more than 600 people at the Geneva University. Four speakers (the astrophysicists H.Reeves and J.Geiss, the physicist G.Laval, and the psychiatrist J.M.Aubry) presented to the public different aspects related to “Deuterium, helium, lithium: From the Big Bang to the contemporary civilisation”.

Finally, with a 25% of the Symposium speakers being women, we considered it appropriate to organize a Women Networking Lunch, to let the participants from different countries exchange their experiences. The event turned out to be quite successful and we all enjoyed the opportunity to interact with other women astronomers coming from different environments. In addition F.Primas, who is co-chairing the IAU Working Group Women in Astronomy, gave a talk on Women Career Advancements for the PhD students and postdocs at the Geneva University. We are grateful to her for having had the idea of these activities, for her help in organizing them, and, most importantly, for always being ready to take initiatives against gender and minority discriminations.

It is a great pleasure to thank the Geneva Observatory, the University of Geneva, and the Museum of Natural History of Geneva for hospitality and support. We gratefully acknowledge the financial support of our sponsors, listed on the next page of these Proceedings, and the active contribution of the members of the SOC and the LOC. We are particularly grateful to Chantal Taçoy and Michel Grenon, who both did real miracles for the logistic organization of the Symposium, and to Bob Rood who took most of the pictures included in this volume. Finally, we warmly thank Cristina Chiappini and Francesca Primas for having co-edited these proceedings and shared with us their responsibility.

*Corinne Charbonnel and Monica Tosi, co-chairs SOC,
Geneva, Bologna, February 4, 2010*

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