IAUS 329: The lives and death-throes of massive stars

November 28 to December 2, 2016

Auckland, New Zealand

Topics
- new results from large-scale surveys at different wavelengths and techniques for massive stars and supernovae
- new observational techniques and instrumentation for massive stars and supernovae
- the link between massive stars and their deaths (core-collapse and other SNe)
- short-lived phases of massive stars (LBVs, WRs and RSGs) and their characteristics as supernova progenitors
- constraints on the nucleosynthesis production in supernovae and the production of dust
- explosion mechanisms of supernovae and the parameters required for a successful explosion
- well established facts and open problems in our knowledge of massive stars
- challenges to present theoretical models: 2D and 3D models of interior and atmospheres
- massive stars as astrophysical tools: tracing the Milky Way and other galaxies structure; limits to our interpretation of the high-z Universe

Dear colleagues,

Research on Massive Stars is undergoing a period of rapid progress. While these stars are relatively few in number they are the main driver of chemical and dynamical evolution in galaxies via their stellar winds and explosive deaths in core-collapse supernovae. Our understanding of massive stars is going through a remarkable time of change with long held convictions being shown to be incomplete. This evidence arises from new research concerning the formation and evolution of massive stars and linking this to their deaths in core-collapse supernovae. Now is a fortuitous time to make significant advances in massive star research. We propose a meeting with the central rationale to bring together the two communities that study massive stars and their supernovae.

The impact of massive stars is widely recognized in many areas. They are often used as tools to interpret the conditions and processes arising in different environments (studies of Galactic structure, chemical and dynamical feedback, population synthesis, Starbursts, high-z galaxies and cosmic reionization). In parallel, the development of new instrumentation, analysis techniques and dedicated surveys across all possible wavelengths have delivered large amounts of exquisite new data. This data is now providing a harsh test for the current state-of-the-art theoretical calculations of massive star birth, evolution and death.

We are beginning to gain some measure of success understanding how complex phenomena such as magnetic fields, pulsations, rotation, mergers and multiplicity act within massive stars. This enables us to revolutionize our understanding of short-lived and enigmatic phases such as seen in Wolf-Rayet stars, Red Supergiants, the Luminous Blue Variables and B-Supergiants. But at the same time, mysteries persist surrounding these phases and the supernovae produced by these stars. For example there is growing evidence that all these stars, except the Wolf-Rayet stars, give rise to supernovae.

Finally, while we know individual stars are important, the impact of massive star populations via their evolution and death, including the influence of X-ray and gamma-ray binaries, is of high interest to those studying the high-z Universe. Locating the source of photons needed to reionize the early Universe remains unsolved. Uncertainties in our understanding of massive star populations impacts our interpretation of galaxies at the edge of the observable Universe and how the Universe became transparent.

In view of recent developments and the significant impact massive stars have in the broader community, a new IAU Symposium in late 2016 was proposed and supported by the IAU. The meeting will summarize recent progress and establish stronger links between the massive star community and closely-linked fields, particularly those studying end stages of massive star evolution and massive star cosmic implications.

In particular we plan to address the following topics:
- new results from large-scale surveys at different wavelengths and techniques for massive stars (e.g. influence of rotation, multiplicity fractions, asteroseismology, magnetic fields, high-energy detections, polarization, interferometry) and supernovae (e.g. relative rates of different types, peculiar new classes of events, most energetic and least luminous events)
- new observational techniques and instrumentation for massive stars (e.g. interferometry, astereoseismology) and supernovae (e.g. polarization and light echos)
- the link between massive stars and their deaths (core-collapse and other SNe and GRBs; progenitors of black holes, neutron stars and magnetars)
- short-lived phases of massive stars (LBVs, WRs and RSGs) and their characteristics as supernova progenitors
- constraints on the nucleosynthesis production in supernovae and the production of dust
- explosion mechanisms of supernovae and the parameters required for a successful explosion
- well established facts and open problems in our knowledge of massive stars, particularly in the so-thought well understood phases
- challenges to present theoretical models of interior and atmospheres; connecting interior and atmospheres; wind structure; episodic mass-loss mechanisms; binaries in interaction; gamma-ray production
- massive stars as astrophysical tools: tracing galaxies' structure; tracers of star formation; feedback from massive stars; population synthesis; limits to our interpretation of the high-z Universe; cosmic reionization; first stars and galaxies.

Dr J.J. Eldridge (University of Auckland), Prof Margaret Hanson (University of Cincinnati) and Dr Artemio Herrero (Instituto de Astrofisica) will act as co-chairs of the SOC. The MSWG will assist in the preparation of the final proposal and will pay special attention to guarantee scientific, geographical and gender diversity balance in the SOC following the IAU rules for universality in science. This aim for diversity and balance will be carried through to selection of invited speakers and session chairs. We will also consider the particular importance to early career astronomers of presenting their work at this significant large scale meeting.

The massive star community has traditionally held IAU Symposia with a frequency of 4-5 years (Argentina, 1971; Canada, 1978; Mexico, 1981; Greece, 1985; Indonesia, 1990; Italy, 1994; Mexico, 1998; Spain, 2002; USA, 2007). More recently, a last meeting was held in Greece in June 2013, without IAU sponsorship, but with great success (225 participants from 27 countries). Seeking for a long-term geographical balance, the IAU MSWG selected New Zealand as location for this meeting among a total of seven proposals. We hope that the selection of this venue will allow greater participation by countries in the Asia and Pacific area.

Weblink: http://www.cadc-ccda.hia-iha.nrc-cnrc.gc.ca/en/meetings/getMeetings.html?number=4716
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