NEW WINDOWS ON MASSIVE STARS: Asteroseismology, interferometry, and spectropolarimetry

June 23-27, 2014

Geneva (Switzerland)

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FIRST ANNOUNCEMENT
IAU symposium 307
"NEW WINDOWS ON MASSIVE STARS:
Asteroseismology, interferometry, and spectropolarimetry"
Geneva (Switzerland)
June 23-27, 2014
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* CONTACT:
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* IMPORTANT DATES:
Deadline for grant request: January 31, 2014
Deadline for abstract submission: April 30, 2014
Deadline for early fees (250 CHF): May 15, 2014
Conference: June 23-27, 2014

* SCIENTIFIC RATIONALE:
The important outputs of mass, momentum and energy of massive stars strongly modify their environment and make them key agents in the evolution of galaxies during the whole of cosmic history. Their high luminosities make them objects detectable at far distances in the Universe. Massive stars are thus important probes for studying star formation at high redshifts. As the progenitors of core collapse supernovae, of the long soft Gamma Ray Bursts, and of neutron stars and black holes, they are connected with the most intriguing objects in the Universe.
Their physics is, however, not yet very well known and such basic understanding as the origin of the various massive star populations (Be-type stars, red and blue supergiants, Luminous Blue Variables, Wolf- Rayet stars) are still matters of debate, as well as the nature of the progenitors of the various types of core-collapse supernovae (type IIP, IIL, IIb, IIn, Ibc).
Among the great challenges faced nowadays in our understanding of massive star evolution, we can cite the following two points :
â€¢ Hydrodynamical processes: turbulent flow, rotation, magnetic fields, as well as mass loss, are all basically fluid dynamics of plasmas. These processes, by governing the quantity of fuel available for a given nuclear burning stage, by modifying the chemical structure of the stars, and by allowing the total mass to strongly decline with time have a dramatic impact on the evolution of massive stars. This also has strong consequences on the chemical evolution of galaxies and on the evolution of their spectral energy distribution.
â€¢ Role of multiplicity in massive star evolution : in addition to the complex physics involved in single stars, multiplicity adds new types of interactions through tidal forces, mass transfer and/or stellar mergers, opening the path to a variety of different evolutionary pathways populating various parts of the HR diagram and leading to specific final structures and thus particular supernova events.
Nowadays, asteroseismology, interferometry and spectropolarimetry allow a view into what could have been thought once as unreachable characteristics of stars in general and of massive stars in particular, and thus can provide new clues on how massive stars are evolving:
â€¢ Asteroseismology (MOST, CoRoT, Kepler, BRITE) allows to probe what happens into the interior of stars, to identify the zones where steep gradients of chemical composition and of angular velocity occur. This provides essential clues on transport processes inside stars. These transport processes, together with the change of composition due to nuclear reactions and mass loss by stellar winds and/or through mass transfer in close binaries drive the evolution of stars.
â€¢ Interferometry (e.g. VLTI, CHARA) explores the shape of stars, the structure and the kinematics of their circumstellar environments. This allows us to probe the deformation of stars resulting from fast rotation and/or tidal forces, to explore the physics of disk formation around early-type stars, to obtain diagnostics of possible anisotropies in the stellar winds and probably in the future to determine if latitudinal differential rotation occurs at the surface of massive stars.
â€¢ Spectropolarimetry (Narval, Espadons, HARPSpol) gives information on the amplitudes and topologies of surface magnetic fields. Magnetic fields represent one of the great issues in massive star physics. Fields impact the way angular momentum is distributed in the interior and it may also couple the wind with the surface of the star. These two characteristics probably play a key role in the angular momentum content of the core at the time of the core-collapse event and thus have an important impact on the way stars explode and on the physical properties of the stellar remnants (neutron stars and black holes).
All these three techniques have already obtained fascinating results on massive stars and the time is ripe for organising an international conference focusing on the achievements reached so far. The main aims of the conference will be to:
â€¢ allow astronomers interested in massive stars to understand the basics of these three techniques, to what extent the results obtained depend on the theoretical models used for the interpretation of the observed features, to understand the potential of these techniques as well as their present limitations and future developments;
â€¢ explore the potential benefits and synergies of these techniques used together and also with more classical approaches such as photometry and spectroscopy to address topical questions in massive star evolution;
â€¢ allow observers to learn about the most recent challenges in massive star modeling.

* TOPICS:
The conference will cover the following topics in 6 sessions:

Session 1: CHALLENGES IN MASSIVE STAR EVOLUTION
â€¢ Hydrodynamic processes in massive stars and consequences for understanding the main observed characteristics of massive stars
â€¢ Massive star populations in galaxies
â€¢ Starbursts in distant galaxies
â€¢ Chemical evolution of galaxies

Session 2: ASTEROSEISMOLOGY
â€¢ How are the interesting astrophysical quantities extracted from the data ? To what extent do these values depend on models ?
â€¢ What can be said about the size of the convective core during main sequence evolution ?
â€¢ What can be said about the way massive stars rotate internally ? (solid body or not ?)