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Nuclear Astrophysics: the unfinished quest for the origin of the elements

Wednesday, 20 May 2015 09:00 (35 minutes)

Nuclear astrophysics aims to understand the cosmic origin of the chemical elements and the energy generation in stars. It constitutes a truly multidisciplinary arena that involves researchers in theoretical astrophysics, observational astronomy, cosmochemistry and nuclear physics.
New tools, developments and achievements have revolutionized our understanding of the origin of the elements: supercomputers have provided astrophysicists with the required computational capabilities to study the evolution of stars in a multidimensional framework; the emergence of high-energy astrophysics with space-borne observatories
has opened new windows to observe the Universe, from a novel panchromatic perspective; cosmochemists have isolated tiny pieces of stardust embedded in primitive meteorites, giving clues on the processes operating in stars as well as on the way matter
condenses to form solids (e.g., planets); and nuclear physicists have measured reactions at or near stellar energies, through combined efforts in stable and radioactive ion beam facilities.
This talk will provide an overview of the nuclear history of the Universe and related topics: starting from the Big Bang, when the ashes from the primordial explosion were transformed to hydrogen, helium, and few trace elements, to the rich variety of nucleosynthesis mechanisms and sites in today's Universe. Particular emphasis will be devoted to explosive nucleosynthesis occurring in core-collapse and thermonuclear supernovae, gamma-ray bursts, classical novae, X-ray bursts, superbursts, and stellar mergers.

Primary author: Prof. JOSE, Jordi (UPC Barcelona)

Presenter: Prof. JOSE, Jordi (UPC Barcelona)

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