Universität Basel

Research Project

Astrophysical Processes, their Simulation and Related Nuclear Physics Issues

Third-party funded project

Project title Astrophysical Processes, their Simulation and Related Nuclear Physics Issues
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Stellar evolution and final explosive endpoints like supernovae are the main focus of the present proposal, which describes a continuing e ort in explaining and understanding such astrophysical events and the composition of their ejecta. Several fundamental aspects are discussed in subtopics A through D. A features stellar evolution and wind ejecta of rotating massive stars, and also low mass stars, in terms of (a) understanding their input into galactic chemical evolution and (b) the composition of resulting dust grains which, if preserved, can be detected in meteoritic inclusions. A sideline examines accretion onto white dwarfs in binary stellar systems, aiming at a precise knowledge of the fuel composition of type Ia supernova progenitors. B describes simulations of core collapse and supernova explosions of massive stars, combining (magneto-) hydrodynamics and radiation transport in 3D calculations of rotating and non-rotating progenitors. C covers the understanding of nuclear properties, reactions, and aspects of temperature-dependent high density equations of state, i.e. nuclear features which enter stellar modeling. D finally focuses on explosive nucleosynthesis processes in the scenarios discussed above, covering all of the classical processes from typical hydrostatic burning, explosive burning, s-, p-. νp, r-process, as well as the rp-process in X-ray bursts on neutron stars. Here we also address the question of highly precise, minimum-size reaction networks for the energy generation (and composition information) to be utilzed in the hydrodynamical modeling of such events. Stellar winds and stellar explosions serve as input to galactic evolution. Thus, this proposal covers physics from subatomic to the evolution of galaxies

Keywords nuclear astrophysics, stellar evolution, supernova explosions, explosive nucleosynthesis, nuclei far from stability, chemical evolution of galaxies
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