

RIB physics in astrophysics worldwide

Monday, October 10, 2005 4:35 PM (25 minutes)

As pointed out by Willie Fowler, the goals of nuclear astrophysics are to understand the mechanism of Nucleosynthesis and the process of energy generation in stellar environments. While a good deal is now known on what occurs in quiescent stellar burning, much less is known about pathways to heavy element production in explosive scenario. The former is largely dominated by nuclear reactions involving stable nuclei over long time scales, but the latter occur on much shorter time scale (seconds) and involve radioactive nuclei. With recent technological breakthroughs, it is now possible to measure rates of key nuclear reactions involving short-lived reactants in novae, X-ray bursts and type I supernovae. Such sub-coulomb barrier reactions exhibit very low cross sections, usually involve hydrogen, and are difficult to measure at temperatures in stellar environments. This talk will review how these challenges have been met around the world with the production of intense radioactive beams of low velocities to provide both direct and indirect measurements of the key parameters, namely level resonance strengths. A number of laboratories are now capable of measuring rates of reactions involving radioactive reactants and helping to clarify the mechanism of explosive stellar phenomena. ISOLDE is the benchmark world facility for producing intense beams of radioactive nuclei and can play an important role in such studies; a role that could be unique in the world. Examples of such studies around the world will be presented and discussed in the context of the future of ISOLDE.

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Session Classification: Nuclear Astrophysics

Track Classification: Nuclear astrophysics