Colloquium

Bringing Stars to the Streets: Isotope and energy production studies for societal use

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Wednesday, April 17 ❖ 4:00 P.M. ❖ 118 NSH

Refreshments at 3:30 P.M. in 202 NSH

It has taken centuries for human kind to realize that stars are fueled by fusion reactions. Since then, humanity has not stopped in its attempts to harness energy from these reactions. I will discuss two schemes envisioned as prototypes for fusion reactors. Each of these schemes proposes different fuels and, consequently, different reaction networks. Understanding these networks, the energy and particles released, require, as for stars, knowledge regarding the rates of the reactions involved. As an example, I will present the study of the reactions $^{10}B(p,g)^{11}C$ and $^{10}B(p,a)^{7}Be$, both of which participate in the $p+^{11}B$ reaction network. A facility with high intensity low energy beams, which can be used to explore these reaction networks, will be described.

The drive to understand the stars does not stop with their energy production mechanisms. Stellar nucleosynthesis processes and production of isotopes for medical and fundamental research purposes have many similarities as well. High neutron fluxes are used, via capture or fission, to produce radioisotopes of medical interest. However, in the current age, where there is already a decline in the number of nuclear reactors dedicated to isotope production, the usage of nuclear fission reactors to produce high neutron fluxes is further threatened by the non-proliferation treaty. Alternative methods of isotope production are needed to supply the high demand. One alternative method is the use charged-particle induced nuclear reactions. This could be a very economical solution to the shortage of radioisotopes as numerous commercial particle accelerators cover a large part of the country. Techniques and methods for studying some of these reactions of interest at the Notre Dame Nuclear Science Laboratory will be presented. I will also highlight the advantage of electromagnetic separators to evaluate the dose contribution of longer lived isotopes that cannot be chemically separated.

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