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Nucleosynthesis and Neutrinos in Explosive Astrophysical Events

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The heaviest elements observed in nature are understood to be produced by the rapid neutron capture process (r process), but which astrophysical site(s) host this process remains an open question. The extreme astrophysical conditions required to synthesize neutron-rich nuclei points to explosive events, and in fact core-collapse supernovae (CCSNe) were a long favored site of heavy element production. However modern hydrodynamic simulations now predict CCSNe to not significantly synthesize elements past silver, leaving the origins of elements like europium, gold, and uranium uncertain. Excitingly, the era of multi-messenger observations of the gravitational waves, electromagnetic emission, and neutrino signals from events such as supernovae and neutron star mergers offers promising avenues to understand heavy element origins. Nuclear physics is simultaneously undergoing its own era of revolution, with both theoretical approaches and experiments such as those at TRIUMF pushing towards an understanding of the properties of neutron-rich species populated at crucial times during the r process. Since nucleosynthesis outcomes encode the interplay between nuclear physics, neutrino physics, and astrophysics, studies at the intersection of these areas present valuable opportunities for theory, experiment, and observation to inform one another. In this talk I will discuss the science questions driving my newly established research program at TRIUMF with the hopes of igniting new collaborations within the Canadian subatomic physics community.

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Please select: Experiment or Theory

Theory

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