



University
of Victoria

PHYSICS AND ASTRONOMY COLLOQUIUM (In Person & Online)

Dr. Nicole Vassh
TRIUMF

“Heavy element nucleosynthesis in the multi-messenger era”

Abstract

“Just over 65 years ago Burbidge, Burbidge, Fowler, and Hoyle (B2FH) charted the initial roadmap for nuclear astrophysics. This seminal work recognized that explaining the origins of the heavy elements such as lead, gold, and uranium requires at least two types of neutron capture nucleosynthesis processes with each having distinct astrophysical sites. At the time of B2FH the rapid neutron capture process (r-process) showed itself to be related to explosive astrophysical events largely via the signature of exotic, neutron-rich nuclei in the Solar abundances. Fast forward to today and we have now seen heavy element formation in the act via the impact of lanthanide elements on the observed light curve from the GW170817 merger of two neutron stars. Therefore, nowadays nucleosynthesis studies have several distinct types of observational information to assimilate, presenting the opportunity to make big leaps in our understanding of r-process sites. However, this requires careful consideration of the nuclear physics uncertainties associated with the vastly uncharted territory of neutron-rich nuclei. In this colloquium I will discuss how nuclear physics will play a central role in addressing the question of heavy element origins over the next decade, with world-wide campaigns fixing their aim at new measurements and new theoretical calculations of the properties of still unprobed nuclear species. The timeliness and importance of such work is demonstrated through theoretical r-process studies which synergize efforts across multiple disciplines when seeking to decipher observables. Additionally, the use of statistical methods will be demonstrated to be a unique future direction for nucleosynthesis studies to infer nuclear properties from observation. Since nucleosynthesis outcomes encode the interplay between nuclear physics and astrophysics, such studies present valuable opportunities for theory, experiment, and observation to inform one another and drive progress in each area.”

Wednesday, March 15, 2023

3:30 p.m. PST

ECS 116

Zoom link available on Uvic Event Calendar