Department of Physics and Materials Science

SEMINAR

The first-principles approach to computation
of key astronuclear processes

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Abstract: In nuclear theory, first-principles computations seek to predict nuclear properties by solving the quantum few/many-body Schroedinger equation either exactly or using controlled approximations. Due to recent theoretical insights, progress in advanced computing, and the adoption of statistical/machine-learning methods, we can now follow this approach to obtain precise predictions for nuclear reaction rates with well-justified uncertainty estimates. Such predictions can serve as reliable proxies in astrophysical modeling for nuclear experiments that are difficult or unfeasible. I will discuss the first-principles computation of three key nuclear processes that are important for understanding the history of our universe, the evolution of stars, and the origin of elements: neutron-proton capture, proton-proton fusion, and the magnetic dipole excitation of Calcium-48.

Bio: Dr. Bijaya Acharya is currently a senior postdoctoral research associated and a Neutrino Theory Network Fellow at Oakridge National Laboratory. He obtained his BS from Tribhuvan University in Nepal, and his MS and PhD from Ohio University, where he studied properties of halo nuclei in effective field theory. Following his PhD, he has worked as a postdoctoral fellow at the University of Tennessee, Knoxville, and the University of Mainz in Germany before joining Oakridge. Since joining Oakridge, he has been the recipient of the Few-Body Systems Award for Young Researchers, Awarded by The European Research Committee on Few Body Problems in Physics and Few Body Systems for “Key studies of electroweak properties of few-body systems in chiral, pionless, and halo effective field theories, and for the uncertainty quantification of processes relevant to astrophysics.

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