



**S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES**

Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Department of Astrophysics and High Energy Physics

16th January, 2023

3.30 PM

ONLINE/ FERMION

SPEAKER



**Dr. Mukul Bhattacharya,
Eberly Research Fellow at Penn State University**

TITLE OF THE TALK

**Magnetised outflows as potential sites of heavy element nucleosynthesis
and high-energy neutrinos**

ABSTRACT

While nuclei lighter than iron are fused over the course of typical stellar evolution, almost half of the elements heavier than iron are created through the rapid neutron capture process (r-process). These nuclei are thought to be produced in magnetised outflows from neutron-rich explosive events including compact mergers and core-collapse supernovae. In this talk, I will discuss the potential of neutrino-driven winds from strongly magnetised and rapidly rotating protomagnetars as plausible sites for r-process nucleosynthesis. The low entropy and fast expansion timescale in magnetised outflows facilitates the formation of heavy nuclei in comparison to thermal winds. As heavy nuclei can eventually produce ultra-high energy cosmic rays, we examine the acceleration and survival conditions for these nuclei. We also explore the propagation of these jets through a broad range of progenitors: from Wolf-Rayet stars which have shed their envelopes to supergiants which have not. In particular, we compute the time-dependent jet magnetisation and luminosity to analyse the criteria for a successful jet breakout, maximum energy deposited into the cocoon and also the structural stability of these magnetised jets. We show that high-energy neutrinos can be produced for extended progenitors especially blue and red supergiants, and estimate the detectability of these neutrinos with IceCube-Gen2.

HOST FACULTY

Dr. Ramkrishna Das

Associate Professor: ASTROPHYSICS AND HIGH ENERGY PHYSICS
