

SEMINAR NOTICE

Title: *Superconducting Heart of Neutron Stars: Implications for Gravitational Wave Emission*

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Date: October 05 (Monday) 2026; **Time:** 4.30 PM

Venue: Seminar Room (M2-13), Department of Physics, Visva-Bharati

Abstract

We perform a general-relativistic analysis of proton superconductivity in magnetized neutron stars by solving the coupled Einstein-Maxwell equations. The study incorporates microscopically derived pairing gaps based on many-body nuclear interactions within realistic equations of state that include two- and three-body forces and relativistic mean-field models. We examine how magnetic field geometry (toroidal and poloidal) and stellar density (hence mass) affect the topology of type-I and type-II superconducting and normal regions. The results confirm the absence of S-wave superconductivity in the inner core for realistic-mass neutron stars, consistent with observational constraints, and reveal distinct three-dimensional non-superconducting domains: torus-like for toroidal and prolate for poloidal fields, which are not captured in one-dimensional models. These configurations provide new insight into the interplay between dense-matter microphysics and global magneto-hydrostatic stellar structure. This has many implications including possible strong inner magnetic field in a neutron star leading to magnetic deformation and hence continuous gravitational-wave emission as an observable from millisecond pulsars.



Convener, Seminar Committee

29/09/2026

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Head, Department of Physics

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