भारतीय खगोलभौतिकी संस्थान
**INDIAN INSTITUTE OF ASTROPHYSICS**
कोरमंगला **Koramangala,** बेंगलूरु **Bengaluru – 560034.**

## स्नातक अध्ययन मंडल Board of Graduate Studies.

STUDENT SEMINAR
(Part of Comprehensive Examination)

**Speaker:** Ms. Yuvasri G

**Title:** Spectral and Temporal Analysis of Black Hole Ringdown

## सार Abstract

Gravitational waves emitted during black hole coalescence are described in three phases namely inspiral, merger and ringdown. During the ringdown phase, the remnant black hole behaves like a damped oscillator and emits gravitational radiation characterized by complex frequencies known as quasinormal modes (QNMs). Since QNMs depend purely on the intrinsic properties of the black hole such as mass, spin and charge, they serve as black hole footprints. Extracting and analyzing these frequencies to infer black hole parameters gives rise to black hole spectroscopy, which acts as a direct probe for testing General Relativity in the strong field regime using the LIGO-Virgo-KAGRA gravitational wave detectors.

In astrophysical scenarios, black holes residing in galactic centers are influenced by surrounding environments like dark matter and accretion disk. These environmental effects can introduce perturbative features, such as bumps, in the effective potential, which may significantly affect the spectral and temporal behavior of black hole ringdown. We first investigate how the time-domain waveforms of ringdown are affected in such cases. We then examine the spectral (in)stability of the QNM spectrum. However, analyzing such spectral behavior is numerically challenging. We employ spectral methods to compute QNMs and subsequently use pseudospectrum analysis, a powerful tool for assessing spectral (in)stability. By combining frequency-domain and time-domain analyses, we aim to gain deeper insight into the role of such perturbative features in shaping black hole ringdown and their implications for future observations.

शुक्रवार Friday 13, मार्च March 2026

Venue: प्रेक्षागृह Auditorium

Time: 2:30 PM

सभी का स्वागत है All are welcome.