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ICTS Astrophysics Seminar

Title : Improving ringdown accuracy in numerical relativity surrogate waveform models

Speaker : Abhishek Ravishankar (University of Massachusetts, Dartmouth)

Date : Thursday, 15 October 2026

Time : 03:30 PM (IST)

Abstract : Waveform models of binary black hole (BBH) mergers underpin both the detection of gravitational waves and the inference of source properties from them. Numerical relativity (NR) surrogate models are waveform models built directly from NR simulations, leveraging the accuracy of numerical relativity while extending parameter space coverage. The ringdown portion of the waveform is of particular importance, as it underpins various tests of GR and consistency checks on the properties of the remnant black hole. One of the most widely used surrogate models, NRSur7dq4, covers a subspace of the precessing quasi-circular parameter space. It is accurate over the time domain as a whole, but there is evidence that its ringdown accuracy could be improved further, a limitation tied to the surrogate modeling process itself. To address this, I will introduce the surrogate modeling methodology and the structure of our precessing models, then describe how domain decomposition can be used in surrogate construction to tailor modeling choices separately to the inspiral and ringdown while preserving waveform smoothness across the boundary. NRSur7dq4v2, built with this approach, recovers the remnant black hole mass and spin from the ringdown with a median error three times smaller than NRSur7dq4 for aligned-spin systems, and an order of magnitude smaller for non-spinning systems. I will close with parameter estimation results obtained with the model, focusing on heavy BBHs, whose in-band signal is dominated by the merger-ringdown and therefore most sensitive to the improvement.

Venue : Feynman Lecture Hall

Zoom Meeting: <https://icts-res-in.zoom.us/j/95911638955?pwd=PlANNGzX6y9WM1bbhrSqfLqTYfokGw.1>

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