Contribution ID: **10** Type: **not specified**

Invited Talk: Keefe Mitman (Title: Leveraging binary black hole ringdown excitations as probes of astrophysics and tests of GR)

Tuesday, 27 May 2025 13:30 (45 minutes)

Title: Leveraging binary black hole ringdown excitations as probes of astrophysics and tests of GR

Abstract: With the commencement of the LIGO-Virgo-KAGRA Collaboration's fourth observing run, the field of gravitational wave (GW) physics is uniquely poised to collect even more precise data from compact binary coalescences. Consequently, we will soon be able to perform even more stringent tests of general relativity. One such test that is particularly promising is trying to verify black hole perturbation theory's predictions using the ringdown excitations imprinted on the merger's remnant black hole. Doing so, however, requires that we have a robust understanding of these excitations through numerical relativity simulations as well as a means to model them across binary black hole parameter space. In this talk, I will highlight recent advancements regarding our understanding of quasi-normal modes (QNMs) that have made performing this test even more alluring. In particular, I will show how QNMs probe the intrinsic geometry of black holes and even reveal information about the nonlinear nature of Einstein's equations. Following this, I will then explain how we can model QNMs using Gaussian process regression and will provide updates on the current status of these models and how they can be used in gravitational wave data analysis to probe both astrophysics as well as the nature of gravity.