

Environmental imprints on black hole ringdowns: quasinormal modes in matter halos

Tuesday 27 May 2025 09:24 (12 minutes)

Black hole spectroscopy offers insights into the properties of black hole remnants. However, most models assume idealized, vacuum spacetimes, neglecting the astrophysical environments in which black holes reside.

Our most recent results show that the presence of matter halos, such as dark matter distributions, affects the quasinormal modes (QNMs) of black holes. We examined black holes embedded in a variety of matter profiles, including Hernquist and Navarro-Frenk-White distributions.

Our analysis shows that the surrounding environment leads to a universal redshift of QNM frequencies and damping times, proportional to the halo's compactness. In this talk I will describe the numerical techniques used to construct these black hole spacetimes and compute their QNMs, and discuss the implications of these findings for gravitational wave observations with next-generation detectors like LISA and the Einstein Telescope.

Primary author: PEZZELLA, Laura (GSSI, INFN)

Presenter: PEZZELLA, Laura (GSSI, INFN)

Session Classification: Observational Science (OSB)

Track Classification: Observational Science (OSB): Div1