

TDEs on FIRE: Co-Evolution of Tidal Disruption Event Rates and Host Galaxies across Cosmic Time

The disruption of stars by the strong tidal forces of supermassive black holes at galactic centres produces luminous emission that peaks on timescales of a few weeks to months and decays slowly over roughly a year. These high energy transient phenomena, known as tidal disruption events (TDEs), have been extensively studied in the local universe using diverse observations and theoretical frameworks. However, the study of TDEs at high redshifts has been relatively scarce. The launch of advanced high-resolution, wide-field surveys facilitated by telescopes such as JWST, eROSITA, Vera Rubin Observatory, Nancy Grace Roman Space Telescope (Roman) and Ultrasat is set to revolutionize our understanding of TDEs in the early universe. For the first time, we have explored the rates of TDEs and their correlation with various host galaxy properties across a wide redshift range ($z=1-10$) using the state-of-the-art cosmological zoom-in simulation FIRE-2. Unprecedented resolution of FIRE-2 provides realistic stellar density profiles at the galaxy centres, enabling accurate calculations of tidal disruption rates (TDR) using loss-cone theory. In this talk, I will discuss the key findings from our study, including the strong correlation of TDR with black hole and host galaxy mass and their redshift evolution, the connection between TDR and cosmic star formation history, and the potential for observing off-nuclear TDEs with Rubin, Roman, and Ultrasat at different redshifts.