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Probing Intermediate-Mass Black Holes with Tidal Disruption Events

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The study of intermediate-mass black holes (IMBHs) has recently drawn a lot of attention, since IMBHs can provide critical information on the seed formation process of supermassive black holes (SMBHs) along with the co-evolution of massive black holes (MBHs) and galaxies. However, detecting IMBHs is extremely difficult due to their small masses and dim luminosities. One of the most promising methods for detecting IMBHs is through tidal disruption events (TDEs), in which stars are tidally disrupted by the MBHs.

In this work, for the first time, we calculate the rates of TDEs using the realistic stellar profiles of galaxies and stellar clusters hosting IMBHs. We select a sample of galaxies and stellar clusters, which not only host IMBHs in their nuclei but also have the IMBH masses constrained from dynamical measurements. We then perform a sophisticated loss-cone dynamics calculation and obtain the TDE rates from this sample of IMBHs. We find that TDE rate generally increases with increasing black hole mass in the IMBH regime, which is opposite to the trend found for SMBHs. Moreover, we show that IMBH TDEs produce deeply plunging orbits more frequently than SMBH TDEs. These results are crucial for helping us use TDEs to probe IMBHs and design next-generation transient telescopes.

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