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SgrA* spin and mass estimates through the detection of an extremely large mass-ratio inspiral

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Estimating the spin of SgrA* is one of the current challenges we face in understanding the center of our Galaxy. In the present work, we show that detecting the gravitational waves (GWs) emitted by a brown dwarf inspiraling around SgrA* will allow us to measure the mass and the spin of SgrA* with unprecedented accuracy. Such systems are known as extremely large mass-ratio inspirals (XMRIs) and are expected to be abundant and loud sources in our galactic center. We consider XMRIs with a fixed orbital inclination and different spins of SgrA* (between 0.1 and 0.9) to obtain the number of circular and eccentric XMRIs expected to be detected by space-borne GW detectors like LISA and TianQin. We expect to have several eccentric XMRIs emitting GWs in the detection band and around one circular source if SgrA* is highly spinning. We later perform a Fisher matrix analysis to show that by detecting a single XMRI, the mass of SgrA* can be determined with an accuracy of the order 10ˆ−2M⊠, while the spin can be measured with an accuracy between 10ˆ−7 and 10ˆ−4 depending on the orbital parameters of the XMRI.

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