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Probing black hole hair with gravitational micro-lensing of gravitational waves

Gravitational lensing of gravitational waves (GW) opens up the exciting possibility of studying the properties of the lens. If the wavelength of GW is comparable to the Einstein radius of the lens, diffraction effects modulate the GW waveform. Previous work has shown that if the lens is a stellar mass Schwarzschild black hole (BH), and the GWs have wavelengths detectable by the LIGO-Virgo-Kagra network, then the resulting waveform modulations (with respect to unlensed GWs) enable constraints on the mass of the BH (M), as well as the impact parameter (y). In this work, we determine the additional modulations incurred due to a non-zero hair Q, which could be interpreted as the electromagnetic charge in Reissner-Nordstrom black holes or the torsion parameter in $\mathcal{F}(T)$ gravity. We investigate the prospects of exploiting these modulations to constrain Q.

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