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Black holes immersed in environment

From electromagnetic observations, we know that the supermassive black holes at galactic centers are surrounded by dark and baryonic matter. With the advent of gravitational wave (GW) astronomy, we are poised to probe the details of geometry from where GW gets generated. GWs from binaries containing at least one supermassive black hole will be observed with space-based detector LISA. In such a backdrop it is necessary to know the effect of the environment around such binaries on the geometry and as a consequence on the emitted GW. For this purpose metrics in the presence of the environment must be known. I will discuss how the existence of matter affects the geometry and will unveil the subtleties regarding sound speed which puts restrictions on the matter profile. These corrections may affect GW generation and propagation and may be characterized by future observatories. I will discuss the numerical results for different families of dark matter profiles, namely the Hernquist, the Navarro-Frenk White, and the Einasto models, and the potential prospects of such results. The talk will be based on a paper which is currently in preparation.

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