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## **Gravitational Wave Probes on Self-Interacting Dark Matter Surrounding an Intermediate Mass Black Hole**

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The presence of dark matter overdensities surrounding a black hole can influence the evolution of a binary system. The gravitational wave signals emitted by a black hole binary offer a promising means to probe the dark matter environments near a black hole. The dense region of dark matter can lead to the dephasing of gravitational waveforms, which can be detected by upcoming experiments such as the Laser Interferometer Space Antenna (LISA). The dark matter density profile around the black hole can vary for different dark matter models. Our study specifically investigates the impact of the ultralight self-interacting scalar dark matter (SIDM) on the gravitational wave signals emitted by black hole binaries. A distinctive characteristic of SIDM surrounding a black hole, as opposed to collisionless dark matter, is the formation of a soliton core. We perform a Fisher matrix analysis to estimate the size of the soliton and the corresponding SIDM parameter space that future LISA-like gravitational wave experiments can explore.

### **Submitted on behalf of a Collaboration?**

No

**Authors:** Dr YANG, Xing-Yu (Korea Institute for Advanced Study); KIM, Jeong Han; KADOTA, Kenji (HIAS-U-CAS/ICTP-AP); Prof. KO, Pyungwon (KIAS (Korea Institute for Advanced Study))

**Presenter:** Dr YANG, Xing-Yu (Korea Institute for Advanced Study)

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