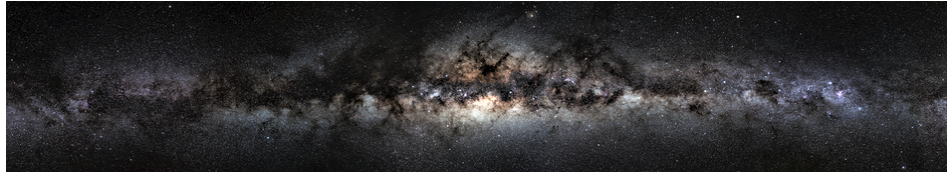


Dark Sectors of Astroparticle Physics (AstroDark-2021): Axions, Neutrinos, Black Holes and Gravitational Waves



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Ionization of Gravitational Atoms

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Superradiant instabilities may create clouds of ultralight bosons around black holes, forming so-called “gravitational atoms.” It was recently shown that the presence of a binary companion can induce resonant transitions between a cloud’s bound states. When these transitions backreact on the binary’s orbit, they lead to qualitatively distinct signatures in the gravitational waveform that can dominate the overall behavior of the inspiral. In this talk, I will show that the interaction with the companion can also trigger transitions from bound to unbound states of the cloud—a process which I will refer to as “ionization,” in analogy with the photoelectric effect in atomic physics. Here, too, there is a type of resonance with a similarly distinct signature in the gravitational waveform, which may ultimately be used to detect any dark ultralight bosonic particles in our universe.

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