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Neutrino Emission from Supermassive Binary Black Hole Mergers

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The first high-probability association of an extragalactic neutrino to the blazar TXS 0506+056 in 2017 identified such active galaxies as potential high-energy neutrino emitters.Two distinct episodes of neutrino emission were detected within 3 years, indicating a possible periodicity. Such periodic behavior is explainable by a supermassive binary black hole system close to its merger as a result of jet precession and jet interactions with surrounding molecular clouds.
We present a model for predicting the arrival times of neutrino flares and gravitational waves for such systems and apply it on TXS 0506+056 assuming that it is an ongoing binary merger. We conclude that the next neutrino emission could already have occurred, possibly still hidden in IceCube's not-yet-analyzed data, and deliver binary properties for a successful detection of its gravitational waves by LISA.
As supermassive black hole mergers could occur more frequently due to merging of
their host galaxies, we further investigate a possible connection between their radiated gravitational wave energy and the diffuse astrophysical neutrino flux that is measured by IceCube. We estimate the contributions of these mergers and binary stellar mass black hole mergers in starburst galaxies on top to the diffuse neutrino flux.

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AGN; Neutrinos; Gravitational Waves

Subcategory

Theoretical Results

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