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Signatures of Superradiant Axions from Lasing and Binary Merger Events

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Superradiant axions around black holes can produce electromagnetic signatures via lasing or via conversion to photons in a strong magnetic field. The latter can also produce gravitational wave signatures besides electromagnetic ones in binary merger events involving a strongly magnetized neutron star and a black hole (BHNS). Due to the smallness of the axion mass, medium effects of the black hole environment and the interstellar medium can significantly affect electromagnetic signatures from lasing. I discuss these medium effects and the conditions under which lasing can take place. I also find that a significant fraction of the energy in the axion condensate can be released via photons in a strong magnetic field of a neutron star within the characteristic time scale of merger events. This could lead to signatures in gravitational waves from merger events of BHNS pairs.

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