

Contributed Talk: Ziyu Tang (Title: A photon cloud induced from an axion cloud)

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Title: A photon cloud induced from an axion cloud

Abstract: It is known that the coupling between axions ($m a = \mu \hbar$) and photons can lead to a superradiant growth and cause electromagnetic (EM) bursts with frequency $\mu/2$ when the coupling constant ka multiplied with the amplitude of the axion cloud ϕ_0 larger than a critical value. In the first-order of the coupling constant, we studied how the existence of an axion cloud influences the distribution of EMs around a Kerr black hole, and found that even for very small couplings, as long as there is a background EM field (satisfying the field equation in Kerr background like Wald vector potential valid in realistic astrophysical environment), there would exist an oscillating photon (EM) cloud with frequency μ same as the axion cloud. The evolution of the photon (EM) cloud with time t and azimuthal angle φ is obtained analytically while the distribution on the cross section is solved numerically. Intriguingly, the induced EMs have very different symmetries in contrast with the background EMs, which may provides as a feature for the existence of both an axion cloud and the axion-photon coupling. Also, for near horizon region, we compare the induced EMs (photons as fields) with the photon region (photons as particles) and find some coincides. Essentially, the induced photon cloud is sourced by the axion cloud via the coupling, not related to superradiance effects.