

Investigation on photon sphere radius of Kerr black hole within plasma environment

Black hole is a large compact object, where the existence of gravity is so strong that any particle or electromagnetic wave cannot escape out of it. Again, no-hair theorem states that a black hole can be characterized by only three parameters: mass, charge and angular momentum. On the other hand, 99% of the visible Universe is composed of plasma, a state of matter dominated by charged particles. The presence of plasma in the region of black holes may affect the equations of motion of photons and charge particles which leads to the modification of the black holes shape and size. In the present study, we basically focus on the behavior of plasma surrounded uncharged rotating black hole (Kerr black hole). In this environment, we have analyzed the variation of photon sphere radius with the rotational parameter and plasma frequency for the Kerr black hole. Here we found that the presence of the plasma increases the photon sphere radius. Again, our findings indicate that the growth for photon sphere radius is less for prograde orbit than the retrograde case. Also, we have noted that for a given plasma frequency, the photon sphere radius of the Kerr black hole decreases when we increase the rotating parameter.

Author: Mr SWAIN, SURYAKANTA (Central University of Himachal Pradesh)

Co-authors: Dr NAYAK, Bibekananda (Fakir Mohan University); Dr SAHOO, Gourishankar (Central University of Himachal Pradesh)

Presenter: Mr SWAIN, SURYAKANTA (Central University of Himachal Pradesh)