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Black hole shadows: from LQG to expanding universe: what can they tell us

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We perform the shadow calculation in a quantum corrected black hole background and at the same time give a generalised prescription for shadow calculation in black holes in an expanding universe. We apply the method of calculation of shadow in the case of a loop quantum gravity motivated regular black hole. In the process, we also construct the rotating loop quantum gravity inspired solution of the originally proposed static spherically symmetric LQG inspired black hole by applying the modified Newman-Janis algorithm. We study the quantum effects on the shadows of both the non-rotating and rotating loop quantum black hole solutions. It is observed that the general shape of the shadow for non-rotating AOS black hole is circular in shape as is expected for its classical counter part, but the presence of LQG inspired modification contracts the shadow radius and the effect reduces with the increase in the mass of the black hole. On a similar note, in the rotating situation, we find contraction in shadow radius due to quantum effects and the tapered nature of the shadow as expected from the classical Kerr case. However, instead of the symmetrical contraction, like non-rotating one, we found more contraction on one side relative to the other when we compare our result with the shadow of the Kerr black hole. We finally studied super-radiance in the rotating background and observed that the super-radiance condition for massless scalar field is identical to that of the Kerr case with the rotation of the BH being more compared to Kerr in the low mass regime.

In-person participation

Yes

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