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The Optical Appearance of a Black Hole

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Since the first theoretical proposition of a black hole solution, it has been one of the most investigated questions that what would be the appearance of a black hole. There have been hundreds of black hole solutions in various frameworks for which studies are available dealing with the optical images of these black hole models. Currently, we call it the black hole shadow as it turns out due to the absence of light from the photon sphere. We still can visualize the boundary of the shadows in the form of a ring of light that essentially is a region where photons are trapped in circular orbits. From such orbits, if they are unstable, the photons will either fall into the black hole or will scatter away to the eye of an observer. Since the discovery of the images of supermassive black holes *M87* and *Sgr A* detected by the EHT collaborations, the study related to the shadows has got a massive boost. The images of *M87* and *Sgr A* also provided some additional data related to the size of the black holes, their distance from the Earth and their mass. This data is sufficient to draw a comparative analysis for the theoretical models of the black holes. The comparison of the black hole shadows with the image size of *M87* and *Sgr A* helps us to find the values of the parameters of the black holes for which that particular black hole model is either *M87* or *Sgr A*. Such an analysis based on the data for *M87* and *Sgr A* would also be useful in testing the gravity theories. In addition, the existence of any plasma distribution around the black hole can also be tested.

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