

Black Hole Shadows and Rings

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Abstract

The presence of a bright “photon ring” surrounding a dark “black hole shadow” has been discussed as an important feature of the observational appearance of emission originating near a black hole. Using analytic calculations and numerical toy models, we argue that neither heuristic is relevant to understanding present observations, at least using pre-existing definitions of the terms. However, when emission from an optically thin accretion disk extends to the region near the horizon, a related phenomenon, which we term a “lensing ring”, can be somewhat important. The lensing ring is a demagnified image of the disk, superimposed on the direct emission. These ideas may help clarify the assumptions underlying the recent M87* mass measurement presented by the Event Horizon Telescope collaboration.