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Shadows of hairy Kerr black holes and constraints from M87*

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We take on an extensive study of the rotating hairy Kerr black holes, which encompasses, in particular cases, the Kerr black hole ($\alpha = 0$). We investigate ergosphere and shadows of the black holes to infer that their size and shape are affected due to the l_0 and are found to harbour a richer chaotic structure. In particular, the hairy Kerr black holes possess smaller size but more distorted shadows when compared with Kerr black holes. We also estimate the parameters l_0 and a associated with hairy Kerr black holes using the shadow observables. The inferred circularity deviation $\Delta C \leq 0.1$ for the M87* black hole is satisfied, whereas shadow angular diameter $\theta_d = 42 \pm 3 \mu\text{as}$, within 1σ region, for a given choice of α , places bounds on the parameters a and l_0 . Interestingly, the shadow axial ratio obeying $1 < D_x$ *lessim* $4/3$ is in agreement with the EHT results and thus eventuates in the hairy Kerr black holes being suitable candidates for astrophysical black holes.

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