Contribution ID: **168** Type: **Talk in the parallel session**

Shadows of hairy Kerr black holes and constraints from M87*

Tuesday, 6 July 2021 06:55 (25 minutes)

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 $\theta_d = 42 \pm 3\mu as$, within 1σ region, for a given choice of α, places bounds on the parameters a and l_0. Interestingly, the shadow axial ratio obeying $1 < D_x$
$lesssim 4/3$ 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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Session Classification: Theoretical and Observational Studies of Astrophysical Black Holes

Track Classification: Black Holes: Theory and Observations/Experiments: Theoretical and observational studies of astrophysical black holes