

Erratum: Twisting shadows: Light rings, lensing, and shadows of black holes in swirling universes [Phys. Rev. D **109**, 104020 (2024)]

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In this erratum, we correct a small set of shadow images presented for the Schwarzschild black hole in a swirling universe. In an attempt to reproduce our published results on shadows and lensing, Rogério Capobianco and Betti Hartmann identified minor inconsistencies. As we revisited the image generation process with a newly implemented code, we confirmed these discrepancies in the gravitational lensing patterns compared to those published. The discrepancies become more pronounced as the swirling parameter j increases. The most noticeable deviation occurs for $jM^2 = 0.0005$, which is illustrated in the bottom right panel of Fig. 1 in this erratum (Fig. 11 in the published version).

While the discrepancies are subtle for smaller values of the swirling parameter, differences are still present. In particular, the updated image for $jM^2 = 0.0003$ differs slightly from the original version. This was verified by overlaying the two images for direct comparison. Conversely, the images corresponding to $jM^2 = 0.0001$ and $jM^2 = 0.0002$ appear visually indistinguishable from those originally published. Additionally, all panels in Fig. 12 of the original paper were generated using $jM^2 = 0.0005$, with only the observer's position varied. Therefore, these images are all corrected in Fig. 2 in this erratum.

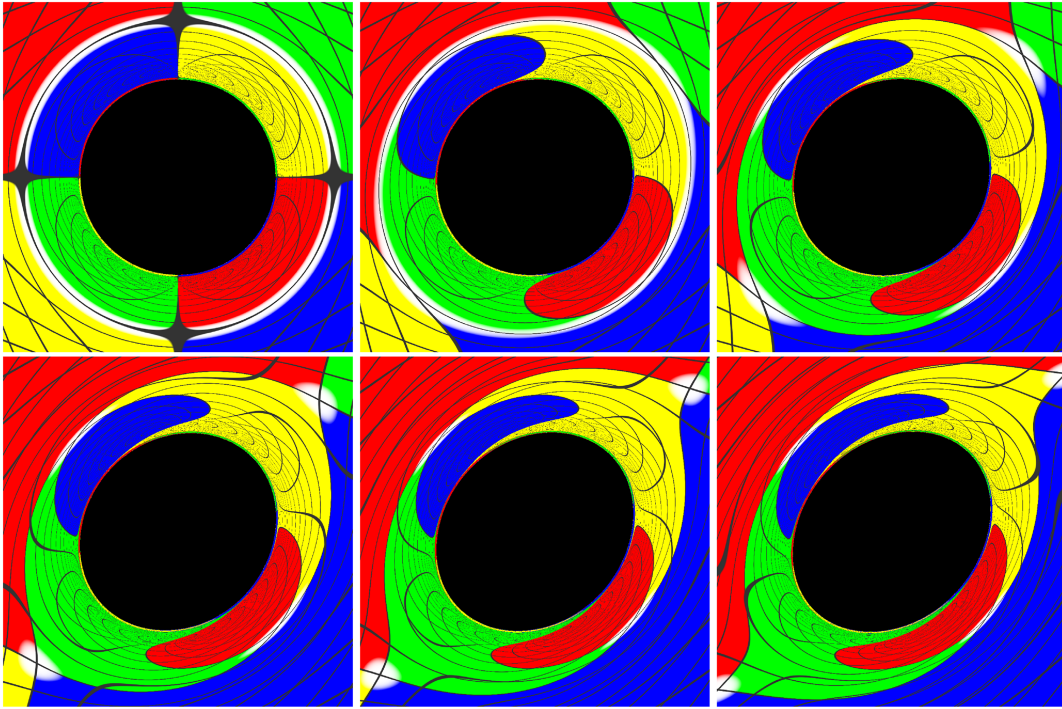


FIG. 1. Shadow and gravitational lensing of the SBHSU, starting with the Schwarzschild case and increasing the swirling parameter j in equal steps of $\delta j = 0.0001$. In all the images, the observer is positioned at the equatorial plane ($\theta = \pi/2$) and at $r = 15M$.

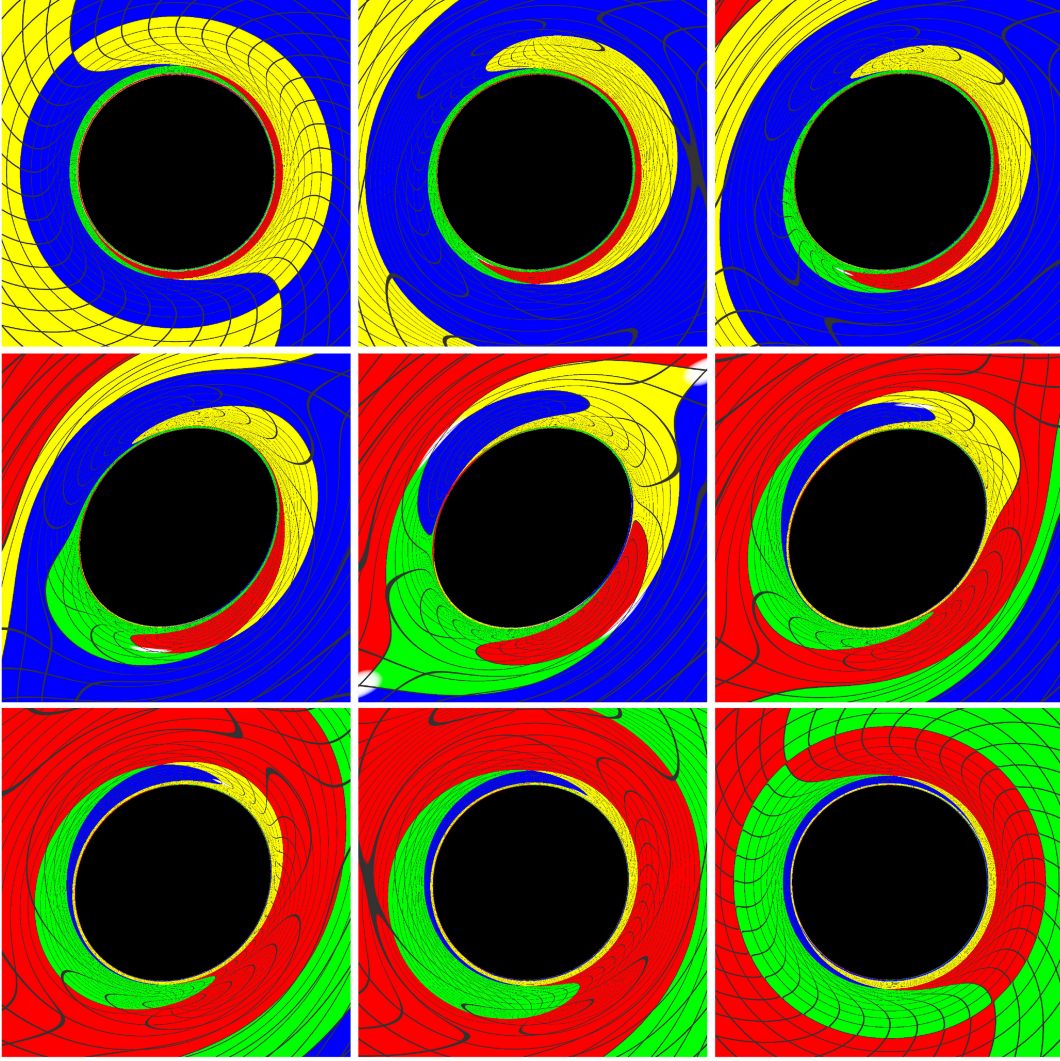


FIG. 2. Shadow and gravitational lensing of the SBHSU, for $jM^2 = 0.0005$, for several observer positions. We start with $\theta = 0$ (on axis observer seeing the BH from the top) and we increase the angle θ in equal steps of $\delta\theta = \pi/8$, until we reach $\theta = \pi$ (on axis observer seeing the BH from the bottom). We kept the radius fixed at $r = 15M$.

We remark that there are no significant differences in the shadow itself. We verified this by overlaying just the shadow contours. We thank Rog rio Capobianco and Betti Hartmann for their correspondence with us. These corrections do not affect the conclusions of the paper.