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Polarized image of equatorial emission in horizonless spacetimes

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We study the linear polarization from the accretion disk around horizonless compact objects. Previous works have shown that these spacetimes can have significantly different lensing properties from black holes. In particular, their relativistic images can exibit a qualitatively new ring structure, inside what would be the shadow region. We search for characteristic signatures which could distinguish these spacetimes from black holes by their polarization properties. To do this, we apply a simplified model of a magnetized fluid ring orbiting in the equatorial plane. We find that for low inclinations, the direct images show a very similar polarization structure to black holes but the intensity of the strongly lensed indirect images can grow up to an order of magnitude compared to that of the Schwarzschild back hole. We also show that the polarization intensity of the new ring structure is significant compared to that of the Schwarzschild black hole and the twist of the polarization vector of these central images is significantly different for the considered spacetimes. Thus while it can be difficult to distinguish horizonless spacetimes from black holes by means of the polarization of their direct images, the strongly lensed indirect images and the qualitatively new central ring structure provide characteristic signatures which can serve as probes for horizonless objects.

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