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I. Sengo: Shadows of Kerr black holes with synchronised Proca hair

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We report the results of the first comprehensive study on the shadows of fundamental Kerr black holes with Proca hair. Some of these solutions show striking non-Kerr features, such as chaotic patterns, non- smooth shadow edges, and ghost shadows. We illustrate how fundamental photon orbits can help us understand some of these features. Nonetheless, a wide range of solutions where deviations from Kerr are small can also be found, which allow us to constrain the amount of hair compatible with the Event Horizon Telescope (EHT) data. Unexpectedly, given the (roughly) 10% error bars in the EHT data –and in contrast to their scalar cousin model –, some of the black holes with up to 40% of their energy in their Proca hair are compatible with the current data. We estimate the necessary resolution of future observations to better constrain this model.

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