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Static boson stars in the Einstein-Friedberg-Lee-Sirlin theory and their astrophysical images

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Boson stars are non-topological solitonic solutions that stand as robust viable candidates for horizonless black hole mimickers. They are linearly stable in some regions of their parameter space, and additionally admit a robust formation mechanism dubbed as *gravitational cooling*. The pioneering work on boson star solutions dates back to 1968 with the studies of Kaup, where he obtained the boson star solutions in the context of GR in the presence of a complex scalar field with a potential without self interaction terms, known nowadays as mini-boson stars. After that, boson star solutions for different sorts of potentials were studied in the literature. We investigate the static boson star solutions in the so-called Einstein-Friedberg-Lee-Sirlin (E-FLS) theory, performing a complete analysis of the solution space in this model. We study the phenomenological aspects of E-FLS stars, for instance, by investigating the timelike and null geodesics with an emphasis on the analysis of circular timelike orbits and light rings. In order to study the astrophysical signatures of such stars, their images were obtained considering them surrounded by a geometrically thin accretion disk. Our results comprise two different models of accretion disks, namely the optically thin and optically thick disk models. We present a selection of our findings for the astrophysical images of E-FLS stars and discuss their relevance as a possible black hole mimicker.

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