

**CONSTRAINTS ON SANDERS GRAVITY FROM PRECESSION OF
ORBITS OF S2-LIKE STARS: A CASE OF A BULK DISTRIBUTION
OF MASS**

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In this paper we investigate possible applications of the observed orbits of S2-like stars around Galactic Center for constraining the gravitational potentials derived from modified gravity models in the absence of dark matter. To this aim, an analytic fourth-order theory of gravity, nonminimally coupled with a massive scalar field, is considered. We study the constraints on the $f(R, \varphi)$ (Sanders) gravity where R is the Ricci scalar and φ is a scalar field and demonstrate that such constraints could be obtained from the observations of S2-like stars by the present and next generation large telescopes. Our results show that Sanders gravity affects the simulated orbits in the qualitatively opposite way with respect to a bulk distribution of matter (including a stellar cluster and dark matter distributions) in Newton's gravity. This is due to the fact that the extended mass cause the retrograde orbital precession, while Sanders gravity cause the orbital precession in the same direction as predicted by General relativity.