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Influence of tidal love number in pericenter shift of S-stars near Sgr A*.

The Galactic Center (GC) hosting a supermassive black hole, Sgr Ais surrounded by a population of S-stars. The orbit of these S-stars is used as a probe for understanding the nature of gravity in such an extreme environment. In dynamic interaction between stars and a supermassive black hole, tidal interaction plays an important role in determining the fate of the interacting system. Thus in this work, we study in detail the tidal love number of polytopic S-stars near Sgr A. We then used the tidal love number with a multipole expansion l = 2 & l = 3 and estimated their corresponding pericenter shift due to the tidal distortion effect up to a semi-major axis of 500au from the GC. The pericenter shift is estimated for low-mass stars $(0.18 \le M/M\boxtimes \le 1.5)$ and high-mass stars $(1.6 \le M/M\boxtimes \le 30)$ for polytopic index, n = 1, 1.5, 2, 2.5, 3, 4, 4.5 and 5. We found that the pericenter shift due to tidal distortion increases with an increase in stellar mass and a decreasing lower polytropic index. The results estimated are independent of general relativity and its alternative theories. However, the above-estimated pericenter shift will provide precise information on tests which use pericenter shift as a probe for testing gravitational theories near Sgr A*. Several factors that can strengthen the estimations for its application to alternative gravitational theories have also been emphasized.

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