

On the presence of a fifth force at the Galactic Center

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The presence of a Yukawa-like correction to Newtonian gravity is investigated at the Galactic Center, leading to a new upper limit for the intensity of such a correction. We perform a Markov Chain Monte Carlo analysis using the astrometric and spectroscopic data of star S2 collected at the Very Large Telescope by GRAVITY, NACO and SINFONI instruments, covering the period from 1992 to 2022. The precision of the GRAVITY instrument allows us to derive the most stringent upper limit at the Galactic Center for the intensity of the Yukawa contribution ($\propto \alpha e^{-\lambda r}$) to be $|\alpha| < 0.003$ for a scale length $\lambda = 3 \cdot 10^{13} \text{ m } (\sim 200 \text{ AU})$. This improves by roughly one order of magnitude all estimates obtained in previous works.