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Galactic Center S cluster as a reservoir of strong-gravity probes

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Recently, Peissker, Eckart, Zajacek et al. (2020) have reported the discovery of six faint stars in the innermost cluster of the Galaxy, so-called S cluster. These stars, S4711-S4715 and S62, can be monitored in the near-infrared K-band using both photometry and spectroscopy. Their elliptical orbits around the supermassive black hole (Sgr A*) break several records. S4711 with the orbital period of 7.6 years is the shortest period star around Sgr A*. S4714 has a large orbital eccentricity of 0.985 and can potentially reach about 8% of the light speed at its pericenter, which would make it the fastest star detected so far. We characterize these stars in terms of the general relativistic parameter. For future monitoring, we will show predictions of the Schwarzschild precession as well as the Lense-Thirring precession. S62, S4711, and S4714 have the potential to exhibit the Lense-Thirring precession of their ascending nodes from a fraction of an arcsecond up to a few arcseconds per year, depending on the exact orientation as well as the magnitude of the spin of Sgr A. *These stars are thus unique probes of the space-time around Sgr A* on the scale of a few 100 Schwarzschild radii.

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