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Exploring Gravity at Galactic Center

Abstract

The best and most stringent strong-field tests of General Relativity performed so far, as well as the most precise determinations of orbits, have been achieved by pulsar timing, albeit not yet in the Galactic Centre. Pulsars are compact, rotating neutron stars that act like cosmic lighthouses in some of the strongest gravitational fields possible. When a pulsar is found in a binary orbit, it can be used as a test mass that “free falls” in the gravitational potential of the companion. This fall can then be compared with the predictions of GR, but also any other theory of gravity. In particular, taking into account a general spherically symmetric metric, we present analytic calculations for the geodesic motion, and the possible deviations with respect to the standard Schwarzschild case of General Relativity. The advance at periastron and orbital period are studied with the aim to identify corrections to General Relativity. A discussion on the motion of compact object around the supermassive central black hole (Sgr A*) in our Galaxy is reported.