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Exploring gravity in the strong field regime with high throughput X-ray measurements

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High-time-resolution and spectroscopic observations of accreting collapsed objects in the X-ray range provide access to strong-field gravity, through measurements of the motions of matter orbiting a few gravitational radii away from black holes. Key predictions of strong field general relativity, such as relativistic epicyclic motions, precession, light bending and the presence and radius of an innermost stable circular orbit in the close vicinity of a black hole can be verified by making use of the two most important direct diagnostics, i.e. the relativistically broadened iron-lines and relativistic timescale variability, in particular the Quasi Periodic Oscillations. Both the low and high curvature regimes of strong field gravity can be probed by studying super-massive black hole in Active Galactic Nuclei and stellar-mass black holes in X-ray Binaries, respectively. This will afford testing general relativity against those alternative theories of gravity which predict deviations from General Relativity in the strong-field regime. To achieve these goals, very large area X-ray instrumentation with good spectral resolution is required. Prospects in this area of research will be surveyed.

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