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Test of relativistic gravity using the microlensing of broad iron line in quasars

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We show that observation of the time-dependent effect of microlensing of relativistically broadened emission lines (such as e.g. the Fe Kalpha line in X-rays) in strongly lensed quasars could provide data on celestial mechanics of circular orbits in the direct vicinity of the horizon of supermassive black holes. This information can be extracted from the observation of evolution of red / blue edge of the magnified line just before and just after the period of crossing of the innermost stable circular orbit by the microlensing caustic. The functional form of this evolution is insensitive to numerous astrophysical parameters of the accreting black hole and of the microlensing caustics network system (as opposed to the evolution the full line spectrum). Measurement of the temporal evolution of the red / blue edge could provide a precision measurement of the radial dependence of the gravitational redshift and of velocity of the circular orbits, down to the innermost stable circular orbit. These measurements could be used to discriminate between the General Relativity and alternative models of the relativistic gravity in which the dynamics of photons and massive bodies orbiting the gravitating centre is different from that of the geodesics in the Schwarzschild or Kerr space-times.

Primary author: NERONOV, Andrii (University of Geneva)

Co-author: VOVK, Ievgen

Presenter: VOVK, Ievgen

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