

The black hole at the Galactic Center: observations and models

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Now there are two basic observational techniques to investigate a gravitational potential at the Galactic Center, namely, a) monitoring the orbits of bright stars near the Galactic Center to reconstruct a gravitational potential; b) measuring a size and a shape of shadows around black hole giving an alternative possibility to evaluate black hole parameters in mm-band with VLBI-technique. At the moment one can use a small relativistic correction approach for stellar orbit analysis (however, in the future the approximation will not be not precise enough due to enormous progress of observational facilities) while now for smallest structure analysis in VLBI observations one really needs a strong gravitational field approximation. We discuss results of observations, their conventional interpretations, tensions between observations and models and possible hints for a new physics from the observational data and tensions between observations and interpretations. We discuss an opportunity to use a Schwarzschild metric for data interpretation or we have to use more exotic models such as Reissner – Nordstrom or Schwarzschild – de-Sitter metrics for better fits. From an analysis of S2 star trajectory we obtained a graviton mass constraint $m_g < 2.9 \times 10^{-21}$ -eV which is comparable and consistent with the constraint 1.2×10^{-22} -eV given recently by the LIGO collaboration from an analysis of gravitational wave signal corresponding to a binary black hole coalescence.

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