

## **GRAVITATIONAL LENSING IN THE STRONG GRAVITATIONAL FIELD: A CASE OF THE BLACK HOLE AT THE GALACTIC CENTER**

**Alexander F. Zakharov**

*Institute of Theoretical and Experimental Physics, Moscow, 117259, Russia  
Joint Institute for Nuclear Research, Dubna, 141980, Russia*

There are not too many astrophysical cases where one really has an opportunity to check predictions of general relativity in the strong gravitational field limit. For these aims the black hole at the Galactic Center is one of the most interesting cases since it is the closest supermassive black hole. Gravitational lensing is a natural phenomenon based on the effect of light deflection in a gravitational field (isotropic geodesics are not straight lines in gravitational field and in a weak gravitational field one has small corrections for light deflection while the perturbative approach is not suitable for a strong gravitational field).

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.