Towards improved constraints on modified gravity using Einstein rings

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Galaxy-scale strong lensing systems are key for testing modifications of general relativity at the few kpc scales. In particular, combining the kinematics of the central galaxy with the lens modeling allows one to set constraints on the so-called slip parameter η, which is the ratio of the two scalar potentials for general metric theories. The current constraints on η are either based on a single system at low redshift or on a heterogeneous sample of lenses, which have only a coarse measurement of the velocity dispersion and are subject to strong modeling assumptions. We are carrying out a systematic study to improve the statistical measurements of η with Einstein rings in a number of ways by: i) providing a new sample of systems, with a more homogeneous selection and analysis; ii) performing a more self-consistent analysis, using the mass and luminosity profiles derived from the data for each system; iii) addressing some of the systematics of the previous analyses, including improved models for the velocity anisotropy; iv) gathering higher quality data for selected systems, in particular, spatially resolved spectroscopy. In this talk we shall report on the recent progress on points i) through iii) above. In particular, we will present a new sample of Einstein rings obtained using archival images from wide-field surveys. This sample is used in combination with existing samples to yield limits on η, studying its dependence with lens mass and redshift. We find that the data is consistent with the prediction from General Relativity, $\eta = 1$. We show that there is a degeneracy between the estimates of η and the parameters of the velocity anisotropy. However, this more realistic modeling of the kinematics still enables one to derive meaningful constraints on η.