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Galaxy Dynamics and Modified Gravity from Velocity Dispersion in Einstein Rings Systems

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A popular test of General Relativity is to use strong gravitational lensing systems in which the lens object is an early-type galaxy (ETG). In such case there are two independent ways to measure the lens mass, first through the light deviation using the Einstein ring (M_E), second through the velocity dispersion of the lens' stars ($M_{\rm dyn}$). Both of these quantities are related through the post-Newtonian parameter γ_{PPN}, that should be equal to one in General Relativity, as opposed to some modified gravity theories, such as f(R), in which $\gamma_{PPN} \neq 1$. This approach was first used by Bolton et al. in 2006 and, since then, due to the considerable increase in the number of lens systems available, the most recent papers in the matter have presented a substantial reduction in the statistical uncertainties. Nevertheless, the measurement of γ_{PPN} by this method still presents a few sources of systematic errors, a specially concerning one is caused by a simplified assumption on the dynamics of the ETG, namely that the parameter that measure the anisotropy between the radial and tangential components of the velocity dispersion, $\beta = 1 - \sigma_t^2/\sigma_r^2$, is assumed to be constant, whereas literature in galaxy dynamics suggests that it should be radially dependent. The main objective of this work is to investigate the interplay between modelling the dynamics of the ETG acting as a lens and the constraints on γ_{PPN} in Einstein Ring systems. In particular we aim at obtaining the systematic uncertainties on γ_{PPN} when we consider more general models of $\beta(r)$.

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