Seminarium Astrofizyczne

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The Last Stand Before Rubin: tagging and modeling a compilation SL systems with ground-based images

Galaxy-galaxy strong lensing (SL) systems have been extensively used to study the mass distribution in the lenses, high redshift sources and to constrain cosmological parameters. In particular, SL systems are key for testing modifications of General Relativity (GR) by probing the different effects of the metric on the motion of massless (through gravitational lensing) and nonrelativistic bodies (through the stellar velocity dispersion). Deviations of GR are encoded in the so-called post-Newtonian parameter γ. Although these objects are very rare, The Vera Rubin Observatory Legacy Survey of Space and Time (LSST) is expected to discover tens of thousands of SL systems. As a preparation for this unprecedented amount of data, our group has extensively compiled thousands of SL candidates in ground-based surveys, among which a few hundred are expected to be suitable for modeling. We refer to this comprehensive compilation of gravitational lenses as "The Last Stand Before Rubin" (LaStBeRu). To identify good SL candidates, we have been carrying out a comprehensive classification of these objects, tagging source, lens, and environment properties. As a direct application of this classification, we have been conducting extensive modeling of the best systems in the sample using a custom-made semi-automated pipeline which iteratively reconstructs noise-map and PSFs (point-spread-functions) and applies the Source Lens and Mass (SLAM) pipelines, which builds up upon Etherington et al., 2021. So far, we have derived modeling results for around 160 strong lensing systems. As one of the multiple potential applications of this database and aiming at testing modified gravity, we selected a small subsample of 20 SL systems to carry out spectroscopic follow-ups in the Southern Astrophysical Research (SOAR) Telescope. We obtained a value of the post-Newtonian parameter of γ=1.13-0.25+0.21 purely from ground-based observations in a self-consistent analysis, with priors on the light and mass distribution derived from the same dataset (and with the PSF measured directly at the spectrograph). This result is consistent with GR (γ=1) at 68.7% confidence level.

Serdecznie zapraszam,
Margherita Grespan, on behalf of the SOC