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Cluster strong lensing cosmography: robust cosmological constraints from a sample of galaxy clusters

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Galaxy cluster strong lensing has numerous applications in cosmology. Thanks to the wealth of multi-wavelength observations of clusters using state-of-the-art observatories, such as the Hubble Space Telescope and the Very Large Telescope, this field is providing significant contributions to the understanding of our Universe. One of the main points that are still not fully understood is the nature of the components of the Universe. The upcoming generation of observational surveys of the cosmos were designed to probe Dark Matter and Energy as one main scientific goals.

One cosmological probe not yet fully explored is the cluster strong lensing cosmography. Although the main contribution to the light deflection of lensed galaxies is the gravitational potential of foreground galaxies, the background geometry of the Universe has a non-negligible effect. Thanks to the high accuracy of current strong lens models, we can probe this "secondary" quantity with unprecedented precision. In the ΛCDM framework, these quantities are Dark Matter and Energy densities, and the Dark Energy equation of state.

In this talk, I will present the combined strong lensing constraints on the quantities above from a sample of galaxy clusters, in contrast to what was done in single systems until today. I will show that the combined constraints are powerful in probing the background geometry of the Universe, and are also nicely complementary to other probes such as the cosmic microwave background, Supernovae-Ia and Baryonic Acoustic Oscillations. Hence, cluster strong lensing will be a competitive cosmological probe and paramount in the observations of the next generation of surveys such as the Rubin Observatory Legacy Survey of Space and Time (LSST) and Euclid space telescope.

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