COSMOLOGY

Cosmic shear to the rescue

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Weak gravitational lensing (pictured) leads to background galaxies (shown in the picture in cyan) being distorted in shape due to foreground matter (shown in red), the ensemble of sources between us and any background galaxy, making it an optimal tool to statistically probe the total mass budget of the Universe. Marika Asgari and collaborators combine two major surveys to measure this cosmic shear out to a redshift of ~ 1.5 and from that to calculate the cosmic matter density Ω_m , which they find to be in tension with the Planck cosmic microwave background results.

Asgari et al. combine the Kilo-Degree Survey (KiDS) and the Dark Energy Survey (DES), which together cover more than $1,500 \text{ deg}^2$ on the sky, with multi-band photometric data from which galaxy ellipticities are measured. For their analysis, the authors use complete orthogonal sets of E/B integrals (COSEBIs), a powerful tool that separates the E and B modes, correlation functions relating to the type of distortion experienced by the background galaxies. The former is physical, caused by the cosmic shear, while the latter is artificial, due to systematics.

The authors first show that the COSEBIs are insensitive to small-scale variations in the galaxies, which may be due to baryonic feedback effects, thus allowing a very precise measurement of the cosmic shear. The analysis results in a value for S_8 , itself a function of Ω_m , of $0.755^{+0.019}_{-0.021}$. This value is in 3.2σ tension with the value from the Planck Legacy results. This discrepancy adds to the already existing apparent tension between the value of the Hubble constant H_0 calculated by type Ia supernovae and that from Planck.

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