Measuring Cosmic Void profile with Planck lensing potential map

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Recently, Cosmic voids have received a great deal of attention as a promising cosmological probe due to very little or lack of non-linear evolution. One of the interesting techniques is to use Cosmic Microwave Background (CMB) weak gravitational lensing caused by foreground voids to constrain various cosmological parameters. Such method can provide a competitive route for cosmological studies. We have shown in our previous work (Chantavat et al. 2016) that for such a CMB-void lensing study one would need to know the void profile to better than 10% accuracy. In this work, we extract the average cosmic void profile using the Planck lensing potential map. The map is cross-correlated with the "Public Cosmic Void Catalog" where voids are defined through underdense regions in the large scale structures traced by Luminous Red Galaxies from the SDSS-III Baryon Oscillation Spectroscopic Survey (BOSS) DR10 CMASS samples. We stacked Planck lensing potential around 516 voids and constrain parameters in the statistical average void density profile known as the universal void profile from standard LCDM N-body simulation (HSW profile; Hamaus et al. 2014). In this profile, four parameters are needed to describe the shape of voids with different characteristic radii, RV. We found that it is necessary to introduce the environment parameter, gamma_v, in the HSW profile in order to obtain a good fit to the data. The environment parameter has a physical interpretation that voids found in the SDSS data are mostly undercompensated voids and reside within an underdense region.