

# Cluster Cosmology with the South Pole Telescope and the Dark Energy Survey

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The abundance of massive halos (and of the galaxy clusters they host) has long been recognized as an extremely promising probe of the large-scale structure of the universe. Over the past decade, tremendous progress was made, notably thanks to the availability of high-resolution surveys of the Cosmic Microwave Background (CMB), of high-quality measurements of gravitational lensing, and of advanced numerical simulations. The sample of galaxy clusters selected by the South Pole Telescope (SPT, combining the SPT-SZ and SPTpol surveys) in the CMB now exceeds a thousand objects. The weak-lensing based mass calibration using Dark Energy Survey (DES) Year 3 data will be better than 5%. The joint analysis of the cluster abundance and weak-lensing mass calibration is therefore expected to provide significantly tighter cosmological constraints than the current state of the art. In my talk, I will review the SPT cluster cosmology and mass calibration program. I will focus on the almost completed weak-lensing analysis using DES Year 3 data and highlight the current status of the ongoing cosmological analysis. Looking further ahead, I will discuss the potential of CMB lensing for cluster mass calibration with SPT-3G and CMB-S4, synergies with optical wide-field surveys, and the central role of numerical simulations to understand the dynamics of non-linear structure formation.

**Orateur:** BOCQUET, Sebastian