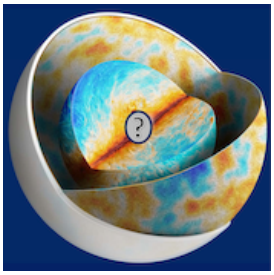

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Constraining the full mass distribution of Planck protocluster candidates with CMB lensing

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Context
Galaxy clusters in formation, or protoclusters, are important sites regarding the star formation history and the evolution of large scale structures, but only their galaxy members have been observed so far. The majority of their mass is expected to be under the form of non baryonic dark matter and intergalactic cold gas.

Aims
The Planck high redshift star-forming fields sample recenses 2151 candidates, among which 1012 fall within the footprint of the Atacama Cosmology Telescope (ACT). The lensing of the Cosmological Wave Background (CMB) by foreground structures allows us to monitor the entire mass distribution of protoclusters for the very first time.

Methods
We use the CMB lensing data from ACT to obtain a mean surface density for the Planck protocluster sample. We then infer the best-fitting parameters for the Navarro-Frenk-White and Einasto density profiles and compute R₂₀₀, an approximation for the virial radius.

Results
The integration of the mass along the line of sight yields values between 1.6 and 1.9 10¹⁵ solar masses. The Einasto model fits the surface density profile better and the corresponding R₂₀₀ values are found to be quite low compared to that of galaxy clusters, which can be interpreted as a sign that these structures are far from being virialised.

Conclusions
We present new arguments showing that the Planck high redshift sample is composed of protoclusters by tracking their full mass for the first time. We also provide estimations for their mean R₂₀₀ without using the virial theorem and find evidence that these protoclusters are mainly out of equilbirium.

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