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A new software to measure pressure profiles from SZ observations

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Galaxy clusters and their distribution in the Universe are a powerful cosmological probe, that can be used at many different wavelengths to set constraints on cosmological parameters. Recent CMB surveys such as Planck, SPT and ACT have led to numerous such studies, by enabling the detection of large samples of nearly mass-selected galaxy clusters detected through the Sunyaev-Zeldovich (SZ) effect. The exploitation of such surveys is limited by its reliance on a prior knowledge of the physical properties of galaxy clusters. Among these properties is the mean pressure profile of galaxy clusters, that is needed for the construction of cluster catalog from millimeter observations. Thanks to the tight link between the observed SZ surface brightness and the pressure distribution in galaxy clusters, high-resolution millimeter instruments are an excellent tool to get precise measurements of this distribution.

We have developed a new software to perform the measurement of galaxy cluster pressure profiles from high-resolution SZ observations. One of the key advantages of the code is the possibility to use binned, non-parametric pressure profiles, enabling possible detections of pressure features better than smooth functions such as the traditionally used generalized Navarro-Frenk-White profile. Another major upside is the software's performance, enabling the extraction of the pressure profile and associated confidence intervals via MCMC sampling in times as short as a few minutes. The code allows the user to take into account various features of millimeter observations, such as PSF convolution, pipeline filtering, correlated residual noise, and point source contamination, in a forward-modelling approach. In this talk, I will present the code and its validation on various realistic synthetic maps, of ideal spherical clusters, as well as of realistic, hydrodynamically simulated objects. We plan to publicly release the software in the coming months.

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