cm-wave observations of cluster mergers: hints of SZ effect structures

Diffuse emission at radio frequencies from clusters of galaxies merging with each other, is referred to as a Radio Halo (RH) when it emanates from the center of the cluster merger, and a Radio Relic (RR) when it emanates from the peripheral regions of the cluster merger. Radio halos and relics typically have steep spectra, and a high-frequency "cut-off", which depends on the energetics of the cluster merger. Recently, a few radio halos relics have been detected at high frequencies (Stroe et al. (2015); Malu et al. (2010,2011)).
We present here results from high frequency (18 GHz) observations of an extremely X-ray luminous cluster (MACS J0417.5-1145), in which diffuse radio emission has been detected at lower frequencies (Dwarakanath et al. (2011)). We have detected diffuse radio emission at 18 GHz in this cluster, as well as a diffuse negative feature, which may be the inverse compton scattering of CMB photons off the thermal / non-thermal electrons in the atmosphere of the clusters, usually referred to as Sunyaev–Zeldovich Effect (SZ effect). The SZ effect has been observed in many clusters (Bleem et al. (2015); Zwart et al. (2011)) by now, though it has only recently been observed at frequencies lower than mm-wave (12-24 GHz; Malu et al. (2011); Massardi et al. (2010); Malu et al. (2017)).
The presence of both positive and negative diffuse signals is interesting, as it allows us to probe different properties of clusters and their mergers. This also presents a unique challenge in imaging, namely ruling out systematic effects in the imaging and deconvolution process mimicking diffuse features.
In this context, we discuss imaging for cluster mergers, and prospects for detection of SZ effect at cm-wavelengths.