



## Sunyaev-Zeldovich Effect 'hole' in the Bullet cluster at cm-wavelength

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We present 18 GHz, i.e., cm-wave or high-frequency radio observations of the Bullet cluster from the Australia Telescope Compact Array; in particular, a high angular resolution measurement of the substructure in Sunyaev-Zel'dovich Effect (SZE). We report the discovery of a compact SZE 'hole' in the galaxy cluster. The SZE hole does not correspond to any bright feature in X-ray, optical, or lensing maps. In general, the relatively deeper SZE feature appears to avoid the regions with the most intense X-ray emission. This implies that the gas pressure distribution differs significantly from the distributions in gas emission measure, galaxy, and dark matter distributions. This has implications for the gas physics and evolution in the cluster merger event. SZE displaced from X-ray centres implies that modeling cluster dynamics is non-trivial; our observations indicate that our current lack of understanding of cluster merger astrophysics may be a limitation to modeling the cosmological distribution in SZE cluster counts and the cluster SZE contribution to small-angle cosmic microwave background (CMB) anisotropy. The SZE distribution in the western parts of the cluster is co-spatial with the radio halo, indicative of a common origin for the hot and relativistic electrons in the turbulent wake of the Bullet.