

# Testing turbulent re-acceleration with joint LOFAR-MeerKAT observations

## Abstract

With this proposal, we plan to exploit the unique joint capabilities of MeerKAT and LOFAR to study the origin of giant radio halos (RH) in galaxy clusters. Giant halos are megaparsec-scale radio sources that are believed to trace cosmic rays re-accelerated by merger-induced turbulence. Halos provide important information on the physics of the intracluster medium (ICM) since they probe the still poorly understood mechanisms that transfer the energy from large-scale turbulent motions to the micro-scales relevant for cosmic-ray acceleration. A key pillar of the turbulent re-acceleration model is the physical connection between the amount of turbulent energy, related to the cluster merger event, and the resulting radio synchrotron spectral shape. Combining MeerKAT observations with the largest statistical sample of RH compiled from the LOFAR Two-metre Sky Survey, we will attempt for the first time to directly probe this physical connection by (1) measuring how the distribution of RH spectral indices relates to cluster mass and (2) determining if the RH spectral indices correlate with the cluster's dynamical state.