

Exploring new regimes in particle acceleration physics: the galaxy cluster pair Abell 141

Abstract

Recent LOFAR observations have discovered gigantic radio bridges that connect massive clusters in pre-merger phase challenging our understanding of the physics of galaxy clusters and of their non-thermal components.

We propose MeerKAT observations of Abell 141, a dynamically disturbed system that is dominated by two massive clusters (A141-North and A141-South) that are nearly close to merge but still in a pre-merger phase. Murchison Widefield Array (MWA) data suggest the presence of a very steep spectrum radio halo centered on A141-North. MWA images also show a tantalizing extension of the radio emission in the direction of A141-South in the region where gas is likely compressed and heated while the two clusters are approaching each other. However the poor spatial resolution and sensitivities of these observations do not allow a firm conclusion.

The proposed MeerKAT observations will allow us to unveil the nature of the diffuse emission and to obtain unique constraints on its spectrum. The study of both very steep spectrum radio halos and inter-cluster bridges are key in our understanding of stochastic particle acceleration mechanisms that are powered by clusters dynamics and that operate in novel regimes. In particular if a radio bridge is detected this would be the third inter-cluster bridge detected so far, furthermore it would probe a peculiar dynamical situation -just 500 million years before the central merger- where simulations predict that the radio emission generated across the entire system reaches its maximum luminosity.