

Title

Abell 2163: characterising the non-thermal components of the cluster from the centre to the outskirts

Abstract

The Intra-Cluster Medium (ICM) in galaxy clusters is filled with cosmic rays (CR) and magnetic fields. Despite their importance, CR are usually observed only in a fraction of the volume of the cluster and our understanding of the strength and distribution of cluster magnetic fields is still limited. In the past decades, CR electrons and magnetic fields have been observed via synchrotron emission in form of radio halos and relics. Recently, the discovery of megahalos demonstrated that even in the outskirts of clusters some mechanisms of particle acceleration maintain a sea of relativistic electrons that emit in the radio band. The aim of this proposal is to obtain the first comprehensive picture of the non-thermal components of a galaxy cluster. The best system to achieve our goal is Abell 2163 ($z=0.2$). This system is the most massive Planck cluster ($M_{500} = 16.1e14$ Msun) and hosts one of the most powerful radio halos ever detected. Hence, Abell 2163 is an ideal candidate to study both the CR distribution and the magnetic field structure from kpc to several Mpc. The main scientific goals of this proposal are: 1. trace the distribution of CR electrons up to and beyond R500; 2. characterise the cluster magnetic field structure from small to large scales.