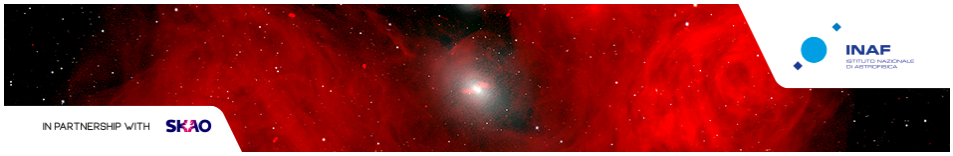

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Constraining the origin of radio halos in galaxy clusters

Wednesday 29 November 2023 10:00 (20 minutes)

A number of galaxy clusters show extended, diffuse, synchrotron emission in their central region. These sources are called radio halos, and are produced by the (re-)acceleration of relativistic seed electrons that fill the magnetised plasma halo of galaxy clusters. However, the nature of the re-acceleration mechanism is unclear. The current leading scenario is based on second order Fermi mechanisms, which are poorly efficient and are predicted to generate a large population of radio halos with very steep spectra (⊠ < -1.5). In this talk, I will present an upcoming study where we provide strong evidence in favour of this scenario, using observations performed with LOFAR. By exploiting survey data from LoTSS and LoLSS of a sample radio halos, we prove for the first time that a large fraction (~65%) shows emission that fades quickly with increasing radio frequency, implying an ultra-steep synchrotron spectrum. In addition, we find a correlation between the cluster mass and the halo spectral index, with more massive clusters hosting flatter halos. The existence of a larger population of ultra-steep spectrum radio halos, with respect to flatter spectrum sources, further validates these models, which predict an increasing fraction of radio halos associated with less massive galaxy clusters.

Reasearch area

Extragalactic Continuum (galaxies/AGN, galaxy clusters)

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