

Dark Matter Gamma-ray searches in Galaxy Clusters: status and prospects

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Galaxy clusters are the largest gravitationally bound structures in the Universe, being completely dark matter (DM) dominated objects. The expected gamma-ray flux from annihilation/decay of DM depends on the target's DM density and its distance to Earth. Thus, for DM decay, local galaxy clusters yield the highest expected fluxes compared to other possible targets, as they are the most massive structures in the Universe. Regarding DM annihilation, clusters can provide fluxes comparable to the ones from dwarf spheroidal galaxies as long as the DM interactions expected in their substructures are taken into account. In this talk, I will present the analysis of 12 years of Fermi-LAT data in the direction of 49 clusters. From the combined search, we found a signal of 2.5-3.0 sigma significance, potentially associated either with DM or hadronic induced emission produced in the intracluster region by cosmic rays colliding with gas and photon fields. Finally, looking into the future, I will also discuss the prospects of the coming Cherenkov Telescope Array Observatory (CTAO), to detect diffuse gamma-ray emission from the Perseus galaxy cluster, where we derive the tightest constraints for DM decay scenarios in the TeV range.

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