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Gamma rays and neutrinos from dark matter annihilation in galaxy clusters

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The γ-ray and neutrino emissions from dark matter (DM) annihilation in galaxy clusters are studied. After about one year operation of Fermi-LAT, several nearby clusters are reported with stringent upper limits of GeV γ-ray emission. We use the Fermi-LAT upper limits of these clusters to constrain the DM model parameters. We find that the DM model distributed with substructures predicted in cold DM (CDM) scenario is strongly constrained by Fermi-LAT γ-ray data. Especially for the leptonic annihilation scenario which may account for the $e^{\pm}$ excesses discovered by PAMELA/Fermi-LAT/HESS, the constraint on the minimum mass of substructures is of the level 10^3-10^4 M$_{\odot}$, which is much larger than that expected in CDM picture, but is consistent with a warm DM scenario. We further investigate the sensitivity of neutrino detections of the clusters by IceCube. It is found that neutrino detection is much more difficult than γ-rays. Only for very heavy DM (~ 10 TeV) together with a considerable branching ratio to line neutrinos the neutrino sensitivity is comparable with that of γ-rays.

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