Contribution ID: **14** Type: **not specified**

Constraining the Milky Way Dark Matter Density Profile with Gamma-Rays with Fermi-LAT

Tuesday 14 June 2011 15:00 (12 minutes)

We study the abilities of the Fermi-LAT instrument on board of the Fermi mission to simultaneously constrain the Milky Way dark matter density profile and some dark matter particle properties, as annihilation cross section, mass and branching ratio into dominant annihilation channels. A single dark matter density profile is commonly assumed to determine the capabilities of gamma-ray experiments to extract dark matter properties or to set limits on them. However, our knowledge of the Milky Way halo is far from perfect, and thus in general, the obtained results are too optimistic. Here, we study the effect these astrophysical uncertainties would have on the determination of dark matter particle properties and conversely, we show how gamma-ray searches could also be used to learn about the structure of the Milky Way halo, as a complementary tool to other type of observational data that study the gravitational effect caused by the presence of dark matter. In addition, we also show how these results would improve if external information on the annihilation cross section and on the local dark matter density were included and compare our results with the predictions from numerical simulations.

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