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GIANT MOLECULAR CLOUDS AS PROBES OF CR PROTONS WITH FERMI-LAT

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The accumulation and effective mixture of relativistic particles during their propagation through the interstellar magnetic fields results in the formation of the so-called “sea” of galactic Cosmic Rays (CRs). The level and the energy distribution of the CR sea is determined by the operation of all galactic accelerators over the confinement time of CRs in the Galactic Disk. The homogeneity of CRs, however, can be violated on smaller scales, in the form of excess fluxes over the CR sea, caused by the injection of fresh relativistic particles by young accelerators into the interstellar medium (ISM). CRs interacting with Giant Molecular Clouds with masses larger than 10^5 Solar masses produce “enhanced” gamma-ray emission which can be used to probe the level of the CR sea throughout the Galactic Disk.

I present the analysis of more than 9 years data of Fermi-LAT on a sample of 18 molecular clouds located at different distances from the Galactic Center. The CR density derived from the gamma-ray data are in a good agreement with the direct CR measurements, confirming that the CR fluxes reported by the AMS collaboration do represent the level of CR; meanwhile in some regions, in particular in the 4-6 kpc molecular ring the CR flux is enhanced and the energy spectrum is noticeably harder compared to the AMS-02 measurements.

Primary authors: Prof. AHARONIAN, Felix (Dublin Institute for Advanced Studies); Ms PERON, Giada (Max Planck Institute of Nuclear physics); Dr YANG, Ruizhi (Max-planck-institute for nuclear physics)

Co-authors: Dr ZANIN, Roberta (Max-planck-institute for nuclear physics); Dr CASANOVA, Sabrina (MPIK & IFJ Krakow)

Presenter: Ms PERON, Giada (Max Planck Institute of Nuclear physics)

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