ANTI-PROTONS FROM DARK MATTER

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Although it is clear from various astronomical observations that the matter content of our Universe is dominated by a component, referred to as dark matter (DM), which differently from ordinary matter, interacts at most very weakly with the Standard Model (SM), still to the day the properties of the DM are still not clear. [1] To constrain these properties, search for both direct and indirect DM signals are ongoing. One method for searching for such signals lies in Cosmic Rays (CR). These are high energy particles, produced in very energetic environments in the universe by astrophysical processes. If DM particles decay or annihilate, they would contribute to the CR flux.

Currently the best constraints on DM properties come from excess- and gamma-ray line searches from Dwarf Galaxies, but in recent years measurements of anti-proton flux have become precise enough, that possibility of competitive constraints have emerged. CRs require background modeling as both the main component and bulk of antimatter is of astrophysical origin. Alpha Magnetic Spectrometer (AMS-02) on the International Space Station has measured that the antiproton to proton ratio stays relatively constant from 20 GeV to 450 GeV energy range [2]. Also the existence of spectral breaks in almost all CR components have been observed. Purely standard production and propagation models have been found to be inadequate. It seems that both new propagation models and possibly new sources are required to explain observations [3]. We develop a model of antiproton background from astrophysical processes and determine limits for DM cross section for decays or annihilation into SM particles.

References

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