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Status of GeV-TeV charged CR propagation models and observational results

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The discovery in 2008 of a cosmic ray (CR) lepton anomaly has raised the tremendous hope that WIMPs were not just a fantasy. The astronomical dark matter is believed to be made of these weakly interacting and massive species whose annihilations would produce an excess of positrons in the cosmic radiation. Alas, the dust has now settled down. Local pulsars are suggested as the probable explanation for the positron excess. Modeling correctly the propagation of galactic cosmic rays in the GeV-TeV range has proved to be crucial in the quest for the dark matter and is also an interesting question per se. I will discuss the status of the models and review the observations on which our description is based. I will pay particular attention to the astrophysical backgrounds inside which the putative dark matter signals could be hidden. I will finally explain why our current description of cosmic ray propagation – on which public codes like GALPROP, DRAGON or USINE are built – needs to be revisited in order to incorporate the Myriad approach. I will apply it to understand the fluxes of primary CR nuclei in the TeV range. As a concluding remark, I will discuss the proton and helium anomalies observed by PAMELA and CREAM as well as the recent AMS02 observations.

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