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Possible Synchrotron Radiation Signal from the Annihilation of Dark Matter at the Galactic Centre and its Detectability at SKA and other Radio Telescopes

Dark Matter particles if accumulated in considerable numbers after being captured inside a massive astrophysical object such as Galactic Centre, may undergo the process of self annihilation to produce Standard Model particles such as fermion-antifermion pairs, gamma rays etc. In case the annihilation products include electrons then under the influence of magnetic field present in the Galactic Centre region, these electrons can emit synchrotron radiation which if detected by the terrestrial radio telescopes could be a possible indirect signature of Dark Matter. In the present work we explore such possibilities by proposing a particle Dark Matter model. In our model, we propose a fermionic Dark Matter candidate by extending the Standard Model of particle physics with a Dirac fermion and a real pseudoscalar. The added fermion which is the Dark Matter candidate interacts with Standard Model via the Higgs portal through a dimension 5 coupling and also by the pseudoscalar. The coupling parameters are constrained by the Dark Matter relic density results from PLANCK experiment and the LHC constraints as also the experimental direct detection limits. Within the framework of this model we then explore the annihilation of this Dark Matter to electron-positron at the Galactic Centre and estimate the synchrotron radiation flux that could be produced. The detectability of these flux at various presently operating and future radio telescopes such as SKA, GMRT, Jodrell Bank etc. are then discussed. The results are shown for two Dark Matter density profiles.

Collaboration name

Primary authors: Prof. MAJUMDAR, Debasish (Saha Institute of Nuclear Physics,); Mr PAUL, Avik (Saha Institute of Nuclear Physics); Dr DUTTA BANIK, Amit (Central China Normal University)

Presenter: Prof. MAJUMDAR, Debasish (Saha Institute of Nuclear Physics,)

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