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Constraining the properties of Dark Matter using multi-messenger observations of dwarf galaxies

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The next generation of telescopes in the gamma-ray, neutrino and radio domains have opened up a promising new avenue through which we can utilise multi-messenger astronomy to understand the nature of Dark Matter. An analysis of neutrino observations with KM3NeT and radio observations with MeerKAT illustrate this potential for DM indirect detection. A comparative analysis of gamma ray observations using CTA and LHAASO further illustrates how the unprecedented sensitivities of the new telescopes exceed those of previous generations. We consider a DM model involving a TeV WIMP that couples exclusively with SM Leptons, via a heavy mediator. It is a generalization of the multiple hypotheses posited to explain the excess Wukong flux detected in late 2017. We simulate the expected indirect emissions from DM Annihilation and Decay in the gamma-ray and neutrino domains, along with the radio domain through the mechanism of synchrotron radiation. One ultra-faint dwarf spheroidal galaxy, Reticulum II, is chosen as the primary observational target. It is DM-dominated, with high astrophysical J and D factors. For comparison, we consider one classical dwarf, Sculptor. Thus, using conservative estimates of the telescope sensitivities, we forecast and interpret strong non-detection upper bounds on the WIMP Annihilation Cross Section and Decay Rate.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

Primary author: Mr NOORBHAI, Raees (Wits School of Physics)

Presenter: Mr NOORBHAI, Raees (Wits School of Physics)

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