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Multi-messenger analysis of Ultrafaint dwarf galaxies as observational targets for Dark Matter indirect detection

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The dwarf spheroidal galaxies orbiting the Milky Way galaxy, particularly the Dark Matter-dominated Ultrafaints, possess excellent discovery potential as observational targets for DM indirect detection. We assess hypothetical, leptophilic WIMPs in the 1 TeV–2 TeV range, with four dwarf galaxies chosen as potential observational targets. These are the Classical dwarf galaxies Sculptor and Sextans, along with the Ultrafaints Reticulum II and Segue 1. For gamma ray observations, we consider the CTA and LHAASO telescopes. For neutrino observations, we consider the KM3NeT infrastructure, while for radio observations we consider the MeerKAT infrastructure. Utilising conservative estimates of the telescope sensitivities, we project non-detection constraints imposed by observations of the dwarf galaxies within the field-of-view of each telescope, calculating upper bounds upon the velocity-averaged annihilation cross-section of the WIMP. Our multi-messenger analysis thereafter compares the projected non-detection bounds imposed by observations of the Ultrafaint dwarf galaxies to those imposed by observations of the Classics, for the different telescopes and their corresponding astrophysical messengers. These projected constraints are taken in comparison to those imposed by prior DM indirect searches in Reticulum II, the Large Magellanic Cloud and the MW Halo and Centre. Also taken into consideration are the direct detection constraints, the collider search constraints, the CMB constraints and the DM relic density limit. Thus, the analysis allows us to determine the optimum combination of telescope infrastructure, astrophysical messenger and target dwarf galaxy for the purposes of imposing the strongest non-detection constraints upon the WIMP parameters.

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No

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

N/A

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