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Probing GeV-Scale Dark Matter Annihilation with the JUNO Experiment

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The Jiangmen Underground Neutrino Observatory (JUNO) is poised to make significant contributions to neutrino physics, including the indirect search for dark matter from the annihilation of WIMPs with masses in the GeV range, which can become gravitationally trapped within the solar core. While Pulse Shape Discrimination (PSD) is a standard technique for classifying events in JUNO, this work demonstrates that a substantial improvement in sensitivity can be achieved by applying dedicated machine learning (ML) and deep learning (DL) algorithms. This enhanced signal-to-background discrimination JUNO can become a leading instrument in the search for solar WIMPs, with a projected sensitivity that is comparable to current limits from major facilities like the IceCube Neutrino Observatory, particularly in the challenging low-mass WIMP range (3-20 GeV). This work highlights JUNO's strong potential to probe the existence of dark matter and its important role in the global multi-messenger effort.

References

<https://doi.org/10.1016/j.pnpnp.2021.103927>, Angel Abusleme et al JCAP09 (2023) 001, J Siripak et al 2023 J. Phys.: Conf. Ser. 2431 012094

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