
Contribution ID: **96** Contribution code: **S4 High Energy and Particle Physics** Type: **Oral Presentation**

# Machine learning application for dark matter - background classification in JUNO experiment

*Thursday 23 June 2022 11:15 (15 minutes)*

Jiangmen Underground Neutrino Observatory (JUNO) has a potential to indirectly detect dark matter (DM), observing neutrino events from annihilations of DM trapped by the gravitational force in the solar core. Weakly interacting massive particle (WIMP) DM candidate with mass $>$ 3-4 GeV has significant solar capture rate. In this work, we simulate JUNO neutrino events from the most dominated WIMP annihilation channel, $\tau\tau^-$. Given the high-energy neutrinos from massive WIMPs, we extend the neutrino-nucleon interactions in the detector to include Quasi-Elastic (QE) and Deep Inelastic scatterings (DIS).
The most challenging background events in the energy range above 100 MeV is the atmospheric neutrinos. The pulse shape discrimination (PSD) method is usually applied to distinguish between DM and atmospheric neutrinos. In this work, we apply Machine Learning (ML) techniques to classify the background events and rare dark matter signals. We found that the Support-Vector Machine (SVM) algorithm gives the best results. Using ML, the accuracy of DM- atmospheric neutrino events classification up to 99.2% with similar f1-score is achievable. On the other hand, only 92-93% maximum accuracy is obtained using linear classification criteria in 3 parameters space. The preliminary JUNO WIMP indirect detection sensitivity will also be presented.

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**Session Classification:** S4 High Energy and Particle Physics

**Track Classification:** High Energy and Particle Physics