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Depletion of ^{39}Ar for Direct Dark Matter Detection Experiments
ZHONGBAO YIN, The University of South Dakota, ANDREW HIME, Los Alamos National Laboratory, DONGMING MEI, The University of South Dakota — Liquid argon, which has shown excellent background discrimination capabilities, is very suitable for construction of tonne-scale target mass detectors at reasonable cost for the WIMP searches. We have investigated via simulations the pulse shape discrimination (PSD) power and found that it depends strongly on the deposited energy and the detected number of photoelectrons per unit energy. To discriminate the backgrounds from ^{39}Ar decays for a tonne-scale dark matter detector, it requires a PSD capability better than 10^{10}, which can only be achievable at a higher threshold energy. Furthermore, without ^{39}Ar depletion, data acquisition dead-time would be unlikely manageable for a tonne-scale detector and a large scale computing facility would be required to perform on-line data reduction. While with depletion of ^{39}Ar by a large factor we can not only reduce the background rate, but also make it possible to lower the detection threshold so as to access larger parameter space of WIMPs predicted by minimal super-symmetric models. In this talk, we will further outline the several ^{39}Ar depletion technologies under investigation in our institutions.

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