

Search for light dark matter with ionization signals in the PandaX-4T Experiment

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We report the search results of light dark matter through its interactions with shell electrons and nuclei, using the commissioning data from the PandaX-4T liquid xenon detector. Low energy events are selected to have an ionization-only signal between 60 to 200 photoelectrons, corresponding to a mean nuclear recoil energy from 0.77 to 2.54 keV and electronic recoil energy from 0.07 to 0.23 keV.

With an effective exposure of 0.55 tonne-year, we set the most stringent limits within a mass range from 40 MeV/c² to 10 GeV/c² for point-like dark matter-electron interaction, 100 MeV/c² to 10 GeV/c² for dark matter-electron interaction via a light mediator, and 3.2 to 4 GeV/c² for dark matter-nucleon spin-independent interaction. For DM interaction with electrons, our limits are closing in on the parameter space predicted by the freeze-in and freeze-out mechanisms in the early Universe.

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