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Probing 5.5 MeV solar axion at the PandaX experiment

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We focus on the detection of 5.5 MeV solar axions from the pp-chain via electron-positron pair production at the PandaX experiment. Previous work established the relation between axion and photon cross sections for massless axions. We verify this relation numerically in the massless limit. Then we compute the cross section for finite axion mass (< 1 MeV) and derive the corresponding mass correction. Our results show that the cross section increases with axion mass, modifying the original relation.

Additionally, we point out that the cross section scales as Z^2, giving high-Z targets like xenon a significant advantage. By combining this Z-enhancement with finite-mass corrections, this work provides a more complete theoretical basis for solar axion searches in high-Z detectors such as PandaX. Furthermore, we estimate the sensitivity for PandaX-4T and show that future PandaX-nT can achieve a sensitivity comparable to Borexino.

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