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A search at Super-Kamiokande for low mass dark matter candidates in the T2K neutrino beam

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The T2K neutrino beam is produced by colliding 30 GeV protons with a graphite target, and some dark sector models predict that a dark matter candidate could be created in the collision. This massive and neutral particle could scatter off a nucleon in Super-Kamiokande, a 50 kilotonne water Cherenkov detector. Similar to the neutral current quasi-elastic neutrino-oxygen interaction, the dark matter candidate could interact with the oxygen nucleus. As the nucleus de-excites, 6 MeV gamma-rays are emitted which can be efficiently detected by Super-Kamiokande. The longer time of flight for a dark matter candidate, compared to a neutrino, allows separation between the dark matter induced signal and the neutrino induced background. In the intense global effort to measure dark matter, this complementary search investigates the sub-GeV mass range where other experiments have reduced sensitivity.

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