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Study of Columnar Recombination in Xe+trimethylamine Mixtures using a Micromegas-TPC

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Electron-ion recombination is experimentally studied in Xe+trimethylamine mixtures, motivated by its potential use for directional dark matter searches. A time projection chamber of 2.4 l with a novel configuration formed by two symmetric drift regions with two microbulk-Micromegas readouts is used to measure the recombination of α - and γ -particles, which are emitted in coincidence by an ^{241}Am source. A gas mixture of 98%Xe+2%TMA is used, varying the pressure from 2 to 10 bar, and the reduced drift field within 10-400 V/cm/bar range.

Both α - and γ -particles exhibit recombination as the electric drift field decreases, being stronger for α - particles. This is partially explained by columnar recombination due to the dependency observed with the track angle (relative to the direction of electric drift field). The comparison of the data with the theoretical models for recombination will be shown and discussed.

These results support a suggestion that has been recently put forward on how to obtain a directional signal in the recoils induced by Dark Matter interactions with xenon-gas. In fact, there are already efforts trying to pursue directionality but with very low masses.

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