

9th edition of the international CYGNUS Workshop on Directional Recoil Detection



Contribution ID: 45

Type: **not specified**

Dark Matter Sensitivity of the CYGNO Detector with eco-friendly Gas Mixtures

Tuesday, 24 February 2026 16:26 (1 minute)

The CYGNO collaboration is developing a novel approach to direct dark matter searches based on a high-resolution optical Time Projection Chamber (TPC). Operating at atmospheric pressure in a He:CF₄ (60:40) gas mixture and equipped with a triple-GEM amplification stage, the detector records the scintillation light produced during electron avalanches. A hybrid optical readout, combining PMT timing information with high-granularity images from an sCMOS camera, enables full 3D reconstruction of particle tracks. CYGNO's expected sensitivity to both spin-independent and spin-dependent interactions is highly competitive among directional dark matter detectors, and the introduction of hydrogen-rich gas components could further enhance performance at low dark-matter masses.

We will present performance studies of MANGO, one of CYGNO's prototype detectors, operated with varying concentrations of the low global warming potential gas HFO-1234ze added to the standard mixture. Measurements of charge gain and scintillation yield across gas configurations are discussed, along with the secondary-scintillation spectra, to evaluate the feasibility of using HFO-1234ze as a gas additive.

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Session Classification: Poster session