

# The 8th International Conference on Micro Pattern Gaseous Detectors (MPGD2024)



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## Improving understanding of negative ion avalanche formation (to be confirmed)

Gaseous Time Projection Chambers (TPCs) have distinct advantages in a WIMP dark matter search, as well as other fields, owing to their ability to sense the highly directional nature of the signals [1,2]. However, increasing the detector scale has presented technical challenges, especially electron diffusion over large drift distances. Electronegative TPC gases, such as SF<sub>6</sub> [3] form negative ions, which show much lower levels of signal diffusion, promising increased track resolution. This improvement however, is accompanied by low achievable gain and poor energy resolution. Efforts to improve the energy resolution have been focused on optimising electron detachment during avalanche amplification in the MPGD detector elements.

In this presentation I will give an overview of the CYGNUS-Oz collaboration, and discuss experimental and simulation investigations focusing on negative ion detachment and avalanche. The experimental measurements make use of an upgraded CYGNUS-1 prototype gaseous TPC operating at the Australian National University. The simulation studies make use of COMSOL multiphysics field simulations and a version of Garfield++ [4], modified to simulate electronegative gases.

[1] C. Lisotti et al., arXiv:2404.03690

[2] S. Vahsen, C. O'Hare and D. Loomba, Annu. Rev. Nucl. Part. Sci. 2021. 71 189-224

[3] N.S. Phan et al., 2017 JINST 12 P02012

[4] H. Schindler, Garfield++. <http://garfieldpp.web.cern.ch/garfieldpp/>, Accessed: 05-06-2024

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