CYGNUS: Directional recoil detection for dark matter, particle physics and nuclear applications

The Australian National University (ANU) has been conducting studies in directional detector technology, with the aim of building a large detector called CYGNUS. Eventually, such a detector is likely to be located in Australia's new underground physics laboratory at Stawell in regional Victoria.

The ANU group leads the experimental efforts of the Australian CYGNUS-Oz consortium through the prototype detectors. The most recent prototype called CYGNUS-n is based on gaseous Time Projection Chamber (TPC) technology. TPCs have an advantage in areas such as directional dark matter searches, as they allow for event-by-event reconstruction of three-dimensional particle tracks with excellent particle discrimination and a high degree of spatial and energy resolution. Recent studies suggest that a large-scale gaseous TPC would be sensitive enough to study solar neutrino fluxes and may offer other novel physics or industrial applications.

This contribution presents the status and results of studies with CYGNUS-n with the future direction of the dark matter research and other applications like particle and nuclear physics. It focuses on R&D and development of optimal TPCs with specific research focus. This includes studies of gas impurities effect on TPC gain and negative ion drifts and the detachment of the electrons from the gain stage.

Workshop topics

Detector systems

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