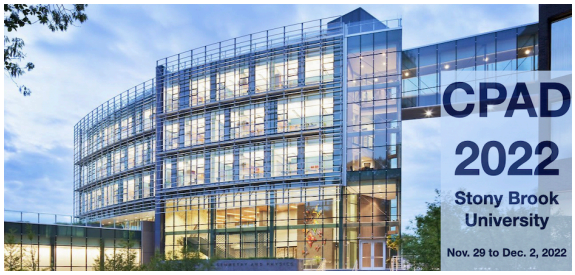

Contribution ID: **128** Type: **Contribution Talk**

The CYGNO experiment, a directional optically readout detector for Dark Matter searches

Tuesday, November 29, 2022 11:50 AM (20 minutes)

We are going to discuss the CYGNO/INITIUM experiment, a recent Dark Matter (DM) project focused on developing a new and innovative approach for directional DM searches: a high precision, optically readout, 3D tracking gaseous Time Projection Chamber. The searches will focus on the detection of low mass (0.5-50 GeV) WIMPS and, eventually, solar neutrino spectroscopy. For its detection medium, this project uses a mixture of He:CF_4 at 1 atm, a low-density gas sensitive to both spin-dependent and independent interactions.

In the CYGNO approach, the charge amplification stage is composed of a stack of three Gas Electron Multipliers, and the readout is carried out through the combined use of a scientific CMOS camera and PMTs which record the light produced during the electron avalanche. By merging the information of the two-dimensional projection (X-Y) obtained with a sCMOS camera and the track's longitudinal tilt (Z) reconstructed using the PMT signal, it is possible to perform a 3D reconstruction of the ionising events. In addition, the camera's high granularity provides a detailed reconstruction of the energy deposition over a path length which enables topology, directional and head-to-tail recognition down to $O(1)$ keV nuclear recoil energies.

In synergy with this, the INITIUM project, an ERC Consolidator project, aims at developing negative ion drift within the CYGNO optical approach.

We will present the latest overground results obtained with our 50 L, 50 cm drift prototype, LIME, concerning the response linearity, energy resolution, data - Monte Carlo comparison, and expected background rejection capabilities. We will also discuss the installation and operation of LIME underground, and the first steps towards the validation of the design of a 0.4 m^3 detector which will ultimately serve as demonstrator of the technology, performance, and scalability of the project for the experiment's phase 1 detector, a $O(30)$ m^3 TPC already competitive with other DM search experiments in the low WIMP mass region.

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