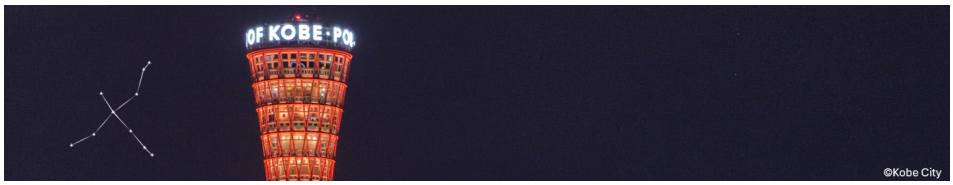

Contribution ID: **5** Type: **not specified**

Space-charge saturation effect and correction at high gain in CYGNO GEM-based detectors

Monday, 23 February 2026 14:00 (25 minutes)

CYGNO is an international collaboration working on the development of a directional detector whose main goal is the direct detection of rare events, such as Dark Matter (DM) in the mass range below a few tens of GeV/c2 , by means of a gaseous detector. It consists in a Time Projection Chamber (TPC) filled with a He:CF4 gas mixture at atmospheric pressure (900 to 1000 mbar) equipped with an amplification stage composed of a triple Gas Electron Multiplier (GEM) structure. Given the scintillating properties of the gas, the readout is optical, based on sCMOS cameras and photomultiplier tubes which allow to image the three-dimensional energy deposition of electron and nuclear recoils down to few keV of energy, through the sensor combination. In low energy rare event searches, the detection of the smallest energy deposition possible is of the utmost importance to improve directional capabilities and DM sensitivity. Besides, while the optical readout can cover wide readout areas with a limited number of sensors, the solid angle coverage strongly suppresses the number of photons they can collect. As a result, extremely large avalanche gains are required from the amplification stage which is limited by the onset of space-charge saturation effects. We will discuss the model of this phenomenon worked out thanks to the studies performed with a CYGNO prototype. Furthermore, we will show the results of different experimental techniques employed to mitigate and correct this phenomenon, while keeping high effective gain. The experimental techniques include the use of a GEM after a V-Bond treatment and alternatively the introduction of a strong electric field, above 10 kV/cm, below the last GEM to distort the electric field and increase the light yield. Achieving large gains in rare event searches detectors optically readout is an extremely relevant problem wherein advancements and new developments could pave the way for the realization of large-scale experiments.

Presenter: DHO, Giorgio (INFN - LNF)

Session Classification: Gas detector R&D