

Commissioning of the MIGDAL detector with fast neutrons at NILE/ISIS

Tuesday, 9 July 2024 14:00 (20 minutes)

Direct dark matter search experiments increasingly rely on the Migdal effect, a rare atomic process, to enhance sensitivity to low-mass WIMP-like candidates. Despite its theoretical prediction in the late 1930s and subsequent observation in radioactive decays, the Migdal effect remains unobserved in nuclear scattering. The MIGDAL experiment aims to achieve the first unambiguous measurement of this phenomenon. We employ a low-pressure optical Time Projection Chamber filled with low-pressure gas to observe nuclear recoils induced by an intense DD neutron generator. Our choice of gas is CF₄, for its avalanche-quenching properties and scintillation in the visible spectrum; the latter of which allows for the tracks to be imaged in high-resolution by a fast, low-noise camera. This is then combined with timing information from an independent ionisation readout to achieve 3D-track reconstruction.

Commissioning data has been collected using fast neutrons at the Neutron Irradiation Laboratory for Electronics (NILE) at Rutherford Appleton Laboratory in the UK. This talk shares the commissioning results, highlighting the detector's performance with a high rate of highly ionising nuclear recoils. Additionally, we will discuss the detector's capability to operate across a wide dynamic range, crucial for imaging the characteristic Migdal topology.

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