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MCP-PMT photodetectors in Cryogenic Environment (12' + 3')

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A number of current and upcoming neutrino and dark matter search experiments employ noble liquid or gases as the detector medium. Operating at cryogenic temperatures, these experiments rely on scintillation light from particle interactions in the medium to infer time and/or position of interaction, crucial for reconstruction and background rejection.

The Argonne Microchannel Plate (MCP) Photodetector Group has successfully built and tested 6cm × 6cm active area MCP photodetectors that feature alkali photocathodes with improved quantum efficiency, pico-second time resolution, and sub-millimeter spatial resolution. Currently, the group is developing components for the MCP photodetector suitable for scintillation detection in cryogenic liquid detectors such as liquid argon TPCs (128nm scintillation) and xenon dark matter detectors (175nm scintillation). We are also exploring ways to mitigate wave length shifting requirements and developing bare-MCP photodetectors to operate in a gaseous cryogenic environment. Status and results from this development work will be discussed.

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