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Photocathodes with VUV-UV-Vis full range response for fast timing and imaging applications (12' + 3')

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Planar microchannel plate photomultipliers (MCP-PMTs) with bialkali photocathodes are able to achieve single photon detection with excellent time (picosecond) and spatial (millimeter) resolution. They have drawn great interests in experiments requiring time of flight (TOF) measurement and/or Cherenkov imaging. Recently, the Argonne ALD manufactured MCPs and photodetector group has demonstrated the reliable production of MCP-PMTs with 6 cm x 6 cm active area. A new thermal bialkali deposition via effusion cell technique is developed to be suitable for mass production. The performance of the photocathode has been improved by optimizing the substrate temperature and film thickness. Currently, these ALD MCP-PMTs have a response range of 300 nm –600 nm, limited by the window transmission and cathode materials. To further support experiments which require detection of ultraviolet (UV) or even vacuum ultraviolet (VUV) photons, the Argonne photodetector group is working towards direct detection of the full spectra range by applying suitable windows and photocathodes with extended UV-VUV response. The progress on photocathode optimization, new photocathode exploration and ALD MCP-PMT performance based these photocathodes will be reported and discussed.

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