Particle Physics Seminar

Large Area Picosecond Microchannel Plate Photodetectors

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Tuesday, April 8 ◆ 4:00 P.M.

Room 415 Nieuwland Science Hall

Microchannel plates (MCPs) and photodetectors using MCPs as a gain multipliers have been in use for many years. Due to the few micron pore size characteristic of MCPs, they feature high precision timing down to a few tens of picoseconds and spatial resolution of a few millimeters. Such detectors would offer an attractive substitute for traditional photomultiplier tubes but the high cost of commercial lead-glass based MCP photodetectors has limited their use to applications requiring small numbers of the tubes. The Large Area Picosecond Photodetector (LAPPD) collaboration formed several years ago with the goal of a transformational change in the performance and cost of MCP photodetectors. The group has succeeded in scaling the active area of MCPs by an order of magnitude while decreasing the cost per unit area by a similar factor. This has been achieved through use of less expensive glass substrates, functionalization of MCPs via atomic layer deposition, and a "frugal" packaging scheme. The MCPs have been demonstrated to have higher gain, lower noise, and improved lifetime compared to available commercial MCP-PMTs. Single photo-electron time resolution < 50ps and spatial resolution < 1 cm have been recorded using our UV laser test setup at Argonne. The lower cost has opened new applications requiring larger numbers of photomultipliers such as water Cherenkov neutrino detection and medical imaging. In the talk I will discuss the development of our MCP photodetector which beyond the MCPs themselves includes development of a novel anode, a waveform sampling ASIC that provides the needed time resolution, techniques for fabricating a vacuum transfer photodetector, and improvement of the photocathode performance. I will also cover the small R&D vacuum transfer system assembled within the Argonne HEP division that will produce 6cm x 6cm active area MCP photodetectors as a step toward production of 400 cm^2 active area devices by our commercial partner, Incom, Inc., and future applications anticipated for the tubes.

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