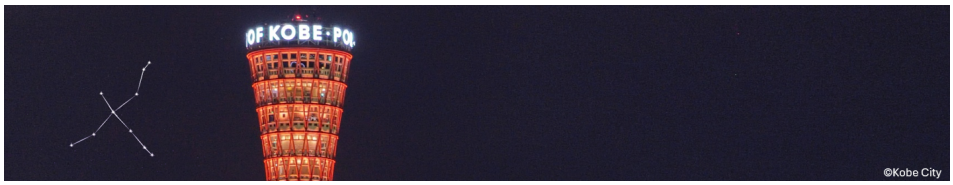

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Optical effects in Gaseous Electron Multipliers (GEMs)

Monday, 23 February 2026 14:50 (25 minutes)

Optical time projection chambers (OTPCs) with GEM amplification are well suited for applications requiring fine spatial granularity for particle track reconstruction. OTPCs reconstruct tracks by measuring the scintillation light produced in the electron avalanche. When simulating tracks in an OTPC, it is often implicitly assumed that scintillation light serves as an accurate proxy of the secondary electrons emerging from the bottom of the GEM(s). That is, tracks and all their properties (energy, dE/dx, etc.) derived using light faithfully reproduce those using charge. Comparisons between simulations and measurement, however, have shown that observed nuclear recoils are systematically brighter and broader than predicted using this assumption. We hypothesize that scintillation light produced inside a GEM hole during the avalanche propagates through the GEM substrate and exits neighboring holes. In this talk, we detail lab measurements made for a variety of GEMs that confirm this hypothesis. Applying our measurements of the optical effects in glass GEMs to simulated tracks using charge, we show that nuclear recoil track widths increase by up to ˜33%. We also present simulations that may be used to inform improved detector design for reducing track broadening in GEM-based OTPCs.

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