Novel noble-liquid detector concepts

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Abstract

Noble liquid radiation detectors are the leading tools in dark-matter searches and neutrino physics. Future large-scale detectors could benefit from recent advances in instrumentation that might solve some of their current drawbacks.

We will introduce novel ideas of radiation-induced ionization-electron and scintillation-photon sensing concepts in *single-phase* and *dual-phase* noble-liquid detectors. They rely on recording photons and electrons by micro-structured electrodes, including ones undercoated with VUV photocathodes. According to the concept proposed, the electrodes are either fully immersed in the liquid, floating on its surface, located in the gas phase or cascaded in both phases. Radiation-induced electrons in the liquid and primary-scintillation photoelectrons emitted from the photocathode are collected onto thin anode strips or micro-patterned surfaces. Combined electroluminescence and charge multiplication in liquid or gas results in fast UV-photon flashes - detected by near-by photo-sensor arrays.

In particular, some of the proposed concepts permit conceiving detectors expected to resolve current liquid-to-gas interface instabilities, typical to large-volume *dual-phase* detectors; it is of high concern in future dark-matter searches. Light and charge multiplication in liquid has the potential of lowering the detection thresholds in current *single-phase* detectors.

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