Coherent Neutrino Detection with Low-Background Micro-Patterned Gaseous Devices

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For the last 25 years, low-energy neutrino detection via coherent nuclear scattering has been a Holy Grail of sorts in the field of neutrino physics: this uncontroversial mode of interaction profits from a sizeable increase in cross section (proportional to the number of neutrons squared in the target nucleus), an extremely advantageous feature in view of the small probability of interaction via all other known channels. A coherent neutrino detector would open the door to many new applications, ranging from the study of fundamental neutrino properties to true "neutrino technology". Unfortunately, present-day radiation detectors of sufficiently large mass (O(1) kg) are not sensitive to sub-keV nuclear recoils like those expected from this mode of interaction. The advent of Micro Patterned Gaseous Detectors (MPGDs), new technologies initially intended for use in High Energy Physics experiments may soon put an end to this impasse. We present here first tests of devices fabricated out of radioclean materials and discuss the approach to characterizing a MPGD sensitive to these weak signals using low-energy highly monochromatic (filtered) neutron beams. Applications are reviewed, in particular their use as a safeguard against illegitimate operation of nuclear reactors by accurate monitoring of the antineutrino emission.