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Cued Antineutrino Detectors Have Limited Potential to Monitor Nuclear Explosions

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In this presentation we discuss findings from a study to test the sensitivity of large gadolinium-doped water detectors to antineutrinos released by nuclear-fission explosions, using updated signal and background models and taking advantage of the capacity for seismic observations to provide an analysis trigger. We find that advances in seismic monitoring and neutrino physics have made the detection of explosion-derived antineutrinos more conceivable than previously asserted, but the size and cost of sufficiently sensitive detectors continue to seriously limit applications. Under certain conditions, the antineutrino signature of a 250-kton pure-fission explosion could be identified several hundred kilometers away, in a detector about the size of the largest module proposed for a basic physics experiment. However, for an explosion two orders of magnitude less yield and more of interest because it is harder to verify as being nuclear in nature, the standoff distance shrinks by an order of magnitude likely requiring locating the detector in-country. In principle, such an observation could provide rapid confirmation that the seismic signal coincided with a fission event, possibly useful for cooperative monitoring of nuclear-weapon test sites but unlikely for detecting explosions at long stand-off distances.

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