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A Large Water-based Liquid Scintillation Detector in Search for Proton Decay $p \to K^+\bar{\nu}$ and Other Physics CHAO ZHANG, Brookhaven National Laboratory — Water-based liquid scintillator (WbLS) is a novel particle detection medium that is mass-producible, cost-effective with high optical performance. It opens the possibility to low energy phenomena that are inaccessible to water Cherenkov detectors. In this talk, we will present the Geant4 based Monte Carlo simulation results of proton decay in the decay channel $p \to K^+\bar{\nu}$ in a 20 kilo-ton WbLS detector. From the simulations an efficiency of 88% for the detection of a proton decay has been determined. The potential backgrounds in the detection energy window have been examined. Within 10 years of measuring time a lower limit of proton lifetime, concerning the decay channel investigated, of $\tau > 2 \times 10^{34}$ y (at 90% C.L.) could be reached. In addition to proton decay, the application of WbLS in other physics, such as in neutrino-less double beta decay and reactor neutrino monitoring will be discussed.

Chao Zhang
Brookhaven National Laboratory

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