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Reducing neutron backgrounds in dark matter detectors with doped water shields KAREEM KAZKAZ, ADAM BERNSTEIN, LLNL, BOB SVOBODA, LLNL, UCD, STEVE DAZELEY, LLNL, LUX COLLABORATION — Neutrons can create false positives in next-generation, low-background Weakly Interacting Massive Particle (WIMP) dark matter detectors via elastic scatters from target nuclei. There is a need to reduce and/or tag both internal and environmental neutrons, thereby allowing event-by-event rejection of these backgrounds. One approach to performing both tasks is to submerge the detector in an active water shield, which may thermalize and capture background neutrons. The resulting neutron capture gamma cascade can produce Cherenkov light that may be observed using photomultiplier tubes, providing a veto signal. By doping the water with certain neutrophage elements, the light output can be significantly increased, leading to greater sensitivity and improved suppression of related backgrounds. We present an analysis of adding neutron-absorbing dopants to an active water shield for LUX, a proposed WIMP detector, and discuss follow-on applications. This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7405-ENG-48. UCRL-ABS-227279.

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