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A Neutron Multiplicity Meter for Deep Underground Muon-Induced High Energy Neutron Measurements RAUL HENNINGS-YEOMANS, DANIEL AKERIB, Case Western Reserve University — The nature of dark matter is one of the most important outstanding issues in particle physics, cosmology and astrophysics. A leading hypothesis is that Weakly Interacting Massive Particles, or WIMPs, were produced in the early universe and make up the dark matter. WIMP searches must be performed underground to shield from cosmic rays, which produce secondary particles that could fake a WIMP signal. Nuclear recoils from fast neutrons in underground laboratories are one of the most challenging backgrounds to WIMP detection. We present, for the first time, the design of an instrument capable of measuring the high energy (>60 MeV) muon-induced neutron flux deep underground. The instrument is based on applying the Gd-loaded liquid-scintillator technique to measure the rate of multiple low energy neutron events produced in a Pb target and from this measurement to infer the rate of high energy neutron events. This unique signature allows both for efficient tagging of neutron multiplicity events as well as rejection of random gamma backgrounds so effectively that typical low-background techniques are not required. We will also discuss the benefits of using a neutron multiplicity meter as a component of active shielding.

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