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HALO – Helium And Lead Observatory for Supernova Neutrinos[1]

STANLEY YEN, TRIUMF, HALO COLLABORATION — Existing neutrino detectors are primarily sensitive to electron anti-neutrinos via charged-current interactions on hydrogen nuclei. The large neutron excess of a heavy nucleus like Pb makes it primarily sensitive to electron neutrinos. This channel is expected to show the most interesting effects of flavor-swapping and spectral splitting due to MSW-like collective neutrino-neutrino interactions in the core of the supernova, the only place in the universe where there is a sufficient density of neutrinos for this to occur. The observation of a galactic core-collapse supernova by a Pb-based neutrino detector, as a complement to other neutrino detectors, would provide a wealth of data for both particle physicists and astrophysicists. The data would provide a test for $\theta_{13} \neq 0$ and an inverted neutrino mass hierarchy, and measure the temperature of the cooling neutron star. HALO is a detector now under construction in SNOLAB, which will utilize 80 tons of surplus Pb blocks, together with the neutral-current detectors from the SNO experiment and the SNO data acquisition system, to provide a low-cost, low-maintenance, long-lived, high-livetime detector.

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