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^{112}Sn Double-Electron Capture to Excited States - A Possible Alternative to Neutrinoless Double-Beta Decay[1] MARY KIDD, JAMES ESTERLINE, WERNER TORNOW, Duke University and TUNL — As first suggested by Winter in 1955 and re-emphasized by Georgi, Glashow and Nussinov in 1981 the double-electron capture (EEC) process on a nucleus with an excited state of the daughter at an energy that coincides with the mass difference between the parent and daughter atoms may play a decisive role in determining the properties of neutrinos. For perfect degeneracy, a substantial resonance enhancement in the capture probability is predicted, and there is no phase space left for the two-neutrino double electron capture. Here we concentrate on ^{112}Sn. Using the TUNL apparatus designed for double-beta decay studies to excited states we placed a 3.9 g foil of enriched (99.5%) ^{112}Sn between our two HPGe detectors. In addition, we surrounded the detectors with rods of natural tin (0.97% of ^{112}Sn), thus providing a total mass of 15.7 g of ^{112}Sn for our search for the coincident detection of 1253.4 keV and 617.6 keV γ rays ($0^+ \rightarrow 2^+ \rightarrow 0^+_{gs}$ sequence). After 60 days of counting we obtained no events in the energy region of interest. This null result corresponds to $T_{1/2} > 1.4 \times 10^{19}$ years (90% CL) for the 0νEEC process. Analysis of the singles spectra, gives a half-life of $T_{1/2} > 4.8 \times 10^{19}$ years (90% CL) for the 0νEEC process.

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