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New limits for the $2\nu\beta\beta$ decay of ^{96}Zr to excited nuclear states of ^{96}Mo[1] SEAN FINCH, WERNER TORNOW, Duke University and TUNL — The final results from our search for the $2\nu\beta\beta$ decay of ^{96}Zr to excited 0^+ and 2^+ states of ^{96}Mo are presented. Such measurements provide valuable test cases for $2\nu\beta\beta$-decay nuclear matrix element calculations, which in turn are used to tune $0\nu\beta\beta$-decay nuclear matrix element calculations. After undergoing double-β decay to an excited state, the excited daughter nucleus decays to the ground state, emitting two coincident γ rays. These two γ rays are detected in coincidence by two HPGe detectors sandwiching the ^{96}Zr sample, with a NaI veto in anti-coincidence. This experimental apparatus, located at the Kimballton Underground Research Facility (KURF), has previously measured the $2\nu\beta\beta$ decay of ^{100}Mo and ^{150}Nd to excited nuclear states. Experimental limits on the $T_{1/2}$ and corresponding nuclear matrix element are presented for each of these decays. As a byproduct of this experiment, limits were also set on the single-β decay of ^{96}Zr.

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