A search for double beta decays of $^{136}$Xe to the excited state of $^{136}$Ba with EXO-200

SERERES JOHNSTON, UMass, EXO-200 COLLABORATION — EXO-200 is one of the most sensitive searches for neutrinoless double beta decay of $^{136}$Xe in the world. The experiment uses 110 kg of active enriched liquid xenon in an ultralow background time projection chamber installed at the Waste Isolation Pilot Plant, a salt mine with a 1600 m water equivalent overburden. This detector has demonstrated excellent energy resolution and background rejection capabilities. While the experiment is designed to search for the double beta decays of $^{136}$Xe to the ground state of $^{136}$Ba, transitions to the excited states of $^{136}$Ba are also plausible. The $\beta\beta2\nu$ decay to the first $0^+$ excited state of the daughter nuclei has been observed for $^{100}$Mo and $^{150}$Nd; this particular transition for $^{136}$Xe has a theoretical lifetime on the order of $10^{25}$ year, which is right around the sensitivity of EXO-200. We present the results from the search of double beta decays to the excited state using two years of EXO-200 data.

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