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Nuclear-Structure Data Relevant to Neutinoless-Double-Beta-Decay Matrix Elements[1]

BENJAMIN KAY, Argonne Natl Lab

An observation of neutrinoless double beta decay is one of the most exciting prospects in contemporary physics. It follows that calculations of the nuclear matrix elements for this process are of high priority. The change in the wave functions between the initial and final states of the neutrinoless-double-beta-decay candidates ^{76}Ge$\rightarrow^{76}$Se, ^{100}Mo$\rightarrow^{100}$Ru, ^{130}Te$\rightarrow^{130}$Xe, and ^{136}Xe$\rightarrow^{136}$Ba have been studied with transfer reactions. The data are focused on the change in the occupancies of the valence orbitals in the ground states as two neutrons decay into two protons. The results set a strict constraint on any theoretical calculations describing this rearrangement and thus on the magnitude of the nuclear matrix elements for this process, which currently exhibit uncertainties at the factor of 2-4 level. Prior to these measurements there were limited experimental data were available $A = 76$ and 100 systems, and very limited data for the $A = 130$ and 136 systems, in a large part due to the gaseous Xe isotopes involved. The uncertainties on most of these data are estimated to range from 0.1-0.3 nucleons. The program started with the $A = 76$ system, with subsequent calculations, modified to reproduce the experimental occupancies, exhibiting a significant reduction in the discrepancy between various models. New data are available for the $A = 100$, 130, and 136 systems. I review the program, making detailed comparisons between the latest theoretical calculations and the experimental data where available.

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