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Neutron beta decay measurements planned for the SNS[1]

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A cold neutron beam line, dedicated to fundamental neutron physics (FnPB), is presently being completed at the Oak Ridge, TN, Spallation Neutron Source. Among other experiments, the beamline will host a comprehensive set of precise studies of the neutron beta decay. Neutron beta decay is characterised by the decay rate (or its inverse, the neutron lifetime), and a set of decay parameters describing the kinematical and spin correlations among the participating particles. Within the standard model (SM), the neutron lifetime and three decay parameters (a, A, and B) are fixed by two parameters: the V_{ud} element of the Cabibbo-Kobayashi-Maskawa mixing matrix, and $\lambda = G_A/G_V$, the ratio of axial vector and vector nucleon form factors. This overdetermined system provides a unique opportunity to explore possible departures from the simple SM, as well as the nature of such departures, e.g., left-right supersymmetric extensions, leptoquarks, non-$(V-A)$ admixtures, etc., with broad implications in subatomic physics. The FnPB neutron beta decay program will include measurements of the neutron lifetime, continuing the present NIST experiment, a measurement of a, the electron-neutrino correlation, and b, the Fierz interference term, (the "Nab" experiment), along with measurements of A and B, the correlations between neutron spin and electron and neutrino momenta, respectively, (the "abBA" experiment). Current plans for these experiments will be discussed in detail.

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