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Frequency-based decay electron spectroscopy

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Precision measurements of β -decay spectra can provide exquisitely sensitive tests of various predictions and underlying symmetry assumptions of the Standard Model (SM) of Particle Physics. Possible symmetry violations can alter the shape of β -decay spectra in characteristic ways. Beyond SM physics e.g. causes the finite masses of neutrinos that alter the β -decay spectrum of tritium in a predictable but still undetectable way. In a first step to design an experiment with a sensitivity of 40 meV/c² to the neutrino mass scale the Project 8 collaboration has recently demonstrated a novel, frequency-based electron spectroscopy technique. Cyclotron Radiation Emission Spectroscopy (CRES) determines the electron's kinetic energy from the feeble cyclotron radiation emitted by an electron spiralling in a magnetic trap. I will present the basics of CRES and results obtained with mono-energetic conversion electrons from ^{83m}Kr as well as preliminary results from measurements using molecular tritium. I will discuss the prospect of CRES in the context of precision β -decay experiments of the next generation, in particular with a focus on the neutron decay spectrum. This work has been supported by the Cluster of Excellence "PRISMA+" (EXC 2118/1) funded by the German Research Foundation (DFG) within the German Excellence Strategy (Project ID 39083149), the US DOe and NSF and by internal investments at all collaborating institutions.

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