Novel techniques for searching for new physics in nuclear beta decays

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Precision measurements of observables that can be accurately predicted by the Standard Model (SM) can be used to search for physics beyond it. One of the most amazing features of the SM is the left-handedness of the charged part of the Weak Interaction, or, equivalently, the fact that electrons emitted from nuclei have their spins almost fully anti-aligned to their momenta (or aligned for the case of positrons.) In the presence of physics beyond the SM, the Vector and Axial-vector currents yield interference effects that can be used to distinguish evidence of new physics. Beta spectra measured with high precision (at the level of a part per thousand or better) allow sensitivities for new physics at the 1-TeV scale and beyond. I will describe the motivation and status of some experiments that are being carried out to achieve high precision in nuclear beta spectroscopy, with emphasis on a new technique called cyclotron radiation emission spectroscopy (CRES) based on detecting the microwave radiation that betas produce when the decays occur within a magnetic field.

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References

[1] Byron et al., Phys. Rev. Lett. **131**, 082502 (2023).