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Francium 7S - 8S Stark spectroscopy as a precursor to atomic parity violation tests.

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Low-energy precision tests of electro-weak physics keep playing an essential role in the search for new physics beyond the Standard Model. Atomic parity violation (APV) experiments measure the strength of highly forbidden atomic transitions induced by the parity violating (PV) exchange of Z bosons between electrons and quarks in heavy atoms. APV is also sensitive to additional interactions such as leptoquarks, and is complementary to other approaches such as PV electron scattering. Our group is working towards a measurement in francium (Z=87), the heaviest alkali, at TRIUMF where we capture Fr atoms in a magneto-optical trap (MOT) online to ISAC. The APV signal in Fr is $\approx 18\times$ larger than in Cs. Working on the atomic 7S-8S transition, the PV observable will be the interference between a parity-conserving amplitude, the ''Stark induced'' E1 amplitude created by applying a dc electric field, E, to mix S and P states, and the vastly weaker PV-induced amplitude. In preparation, we now explore the Stark amplitude, in particular the ratio of its scalar, α, $(E \mid\mid \epsilon)$ and vector, β, $(E \perp \epsilon)$ components, where ϵ is the laser polarization. APV tests will require an accurate value for β, and the measurement of α/β will provide an important benchmark for theory providing β. I will discuss our plans for a precision determination of this ratio, including the challenges of producing spin-polarized Fr in a MOT environment and the sub-ms switching of magnetic fields.

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