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Preparations for Stark-Interference Type Measurements in Francium

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At the Francium Trapping Facility located at TRIUMF our group uses laser cooling and atom trapping techniques to confine Fr and Rb atoms in a magneto-optical trap allowing us to investigate highly forbidden optical transitions in these atoms with precision laser spectroscopy. For Fr, these investigations are important precursors to future atomic parity-violating (APV) experiments. Atomic parity-violation arises from the parity-violating weak neutral interaction between an atom's electrons and nucleons. APV effects scale with nuclear charge roughly like Z^3 making Fr, the heaviest alkali, an ideal candidate for these types of experiments. The highly forbidden parity-violating $E1_{pv}$ transition between 7s and 8s states in Fr is a signature of APV but is too weak to observe directly. We rely on interference of the $E1_{pv}$ amplitude with a parity-conserving Stark-induced $E1_{stark}$ amplitude in the presence of an external electric field - the so-called Stark interference technique - to enhance the APV signal. We will measure the asymmetry of this signal under parity reversals. In this talk I will present theoretical aspects and experimental requirements for realizing an asymmetry measurement in the $E1_{stark}$-M1 interference signal on the same 7s->8s transition in Fr. Measurement of this signal will lend critical experience in interference type measurements in preparation for future APV experiments.

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