# HIGHLY FORBIDDEN TRANSITIONS IN ALKALIS: TOWARDS A PARITY VIOLATION EXPERIMENT

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We present a program to investigate highly forbidden transitions in laser-cooled rubidium and francium atoms confined in a magneto-optical trap. The goal is to study the $5s \rightarrow 6s$ transition in Rb as a precursor to an on-line measurement of $7s \rightarrow 8s$ in Fr at the ISAC radioactive beam facility at TRIUMF. These transitions from the electronic ground state to the first excited s-state have exceedingly faint oscillator strengths. In a purely electromagnetic world, the electric dipole amplitude is strictly forbidden by parity. The magnetic dipole amplitude is also vanishing in a non-relativistic description, but relativistic effects and hyperfine mixing give rise to a small M1 transition amplitude. In the presence of the weak interaction, a parity violating electric dipole amplitude emerges. In cesium, it has been the basis for the most successful atomic parity violation experiment by the Boulder group, yielding competitive constraints on the Standard Model of particle physics. As a first step towards a parity violation experiment in francium (where the effect is 18x larger than in cesium) at TRIUMF, we are carrying out basic spectroscopy on the $5s \rightarrow 6s$ transition in rubidium to characterize it and to gain expertise for an on-line measurement in francium. In view of the weakness of the transition, we start out with a vapor cell experiment in rubidium. The $5s \rightarrow 6s$ transition at 496 nm is excited using a frequency-doubled diode laser system. Macroscopic amounts of francium are not available as it has no stable isotopes, making the vapor cell approach unfeasible. However, in a laser trap, francium atoms can be stored in similar numbers and at similar densities compared to stable alkalis. Transferring the measurement from a vapor/atomic beam to a trap-based scheme in rubidium will yield important insights into implementing the technique on-line for francium.

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