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Observation of Highly Forbidden M1 Transition in 7s-8s Transition in Francium

Saturday, 17 February 2024 22:00 (15 minutes)

Studying atomic parity violation in weak interactions by using atomic spectroscopy-based techniques plays a vital role in testing the Standard Model on a different momentum scale. In Francium Trapping Facility at TRIUMF, we trap and cool francium atoms in a magneto optic trap and then drive a highly forbidden 7s-8s transition in this trapped radioactive atomic sample of francium. Recently, we achieved a milestone by measuring a very faint magnetic dipole transition, 13 orders of magnitude weaker than the allowed transition, with better than 10 % accuracy. In this talk, I will shed light on two crucial contributions: 1) a power build up cavity which increased the light intensity by ~ 4000-fold in the interaction region where atomic sample resides in our apparatus, 2) optical amplification of detection signal by several folds by repeated absorption and emission of photons by the atoms, carrying signature of 7s-8s excitation, on a cycling transition eventually leading into a detectable signal with burst of photons. Our detection technique is now upped to measure the transition rates feasible towards the final atomic parity violation experiment. In this talk, I will discuss our measurement method for M1 transition, the results and how this measurement plays a significant role in getting a step closer towards measuring the atomic parity violation in francium.
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