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Measurement of the $6S_{1/2} \rightarrow 5D_{3/2}$ Magnetic Dipole Transition Amplitude in Ba^+ and Application to a Parity Nonconservation Measurement[1] SPENCER WILLIAMS, ANUPRIYA JAYAKUMAR, MATTHEW HOFFMAN, BORIS BLINOV, NORVAL FORTSON, University of Washington — We present two approaches for measuring the $6S_{1/2} \rightarrow 5D_{3/2}$ magnetic dipole transition amplitude (M1) in $^{137}Ba^+$ and $^{138}Ba^+$ using a frequency stabilized 2.051 micron laser. In the odd isotope, M1 can be measured directly by driving the weak $6S_{1/2}(F = 1) \rightarrow 5D_{3/2}(F = 0)$ transition where the electric quadrupole amplitude (E2) is explicitly zero. For measurement in the even isotope we propose to use laser polarization and magnetic field geometry to tune E2 to roughly the same order of magnitude as M1 for the $6S_{1/2}$ $(m_J = 1/2) \rightarrow 5D_{3/2}$ $(m_J = 1/2)$ transition. M1 can then be extracted from the interference between the E2 and M1 amplitudes and prior knowledge of E2. This work will test state-of-the-art many-body calculations and is relevant to fundamental symmetry searches in atoms. In particular, we are motivated by our interest in measuring atomic parity nonconservation (PNC) in a single trapped barium ion, where the present work will provide essential knowedge of the magnitude of M1 and is an important proof-of-principle test of the method.

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