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Using Tensor Light Shifts to Measure and Cancel a Cell's Quadruopolar Frequency Shift[1] LARRY HUNTER, STEPHEN PECK, NATHANAEL LANE, DANIEL ANG[2], Amherst College — We have developed a new technique that uses the tensor light shift to measure and cancel the frequency shift produced by the quadrupolar anisotropy of a vapor cell. We demonstrate the technique on the $6S_{1/2}$, $F = 4$ level of Cs using the D1 transition. The method extends our ability to study quadrupolar wall interactions beyond diamagnetic atoms. We have deduced the twist angle per wall adhesion for cesium on an alkene coating to be about 1.4 mrad. This value is about 37 times larger than the twist angle observed in ^{131}Xe, suggesting that it is not produced by the interaction of the nuclear quadrupole moment with a collisional electric-field gradient. Alternative mechanisms that may be responsible for the observed quadrupolar frequency shifts are discussed. By cancelling the cell-induced quadrupole shift we have extended our cells' effective spin-relaxation times by as much as a factor of two. This cancellation improves magnetometer sensitivity in highly anisotropic cells and could reduce systematic uncertainties in some precision measurements.

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