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Measurement of an atomic quadrupole moment using dynamic decoupling NITZAN AKERMAN, RAVID SHANIV, ROEE OZERI, Department of Physics of Complex Systems, Weizmann Institute of Science. — Some of the best clocks today are ion-based optical clocks. These clocks are referenced to a narrow optical transition in a trapped ion. An example for such a narrow transition is the electric quadrupole $E2$ transition between states with identical parity. An important systematic shift of such a transition is the quadrupole shift resulting from the electric field gradient inherent to the ion trap. We present a new dynamic decoupling method that rejects magnetic field noise while measuring the small quadrupole shift of the optical clock transition. Using our sequence we measured the quadrupole moment of the $4D_{\frac{5}{2}}$ level in a trapped $^{88}Sr^{+}$ ion to be $2.973^{+0.026}_{-0.033}\, ea_0^2$, where e is the electron charge and a_0 is the Bohr radius. Our measurement improves the uncertainty of this value by an order of magnitude and thus helps mitigate an important systematic uncertainty in $^{88}Sr^{+}$ based optical atomic clocks and verifies complicated many-body quantum calculations. (Ref: arXiv:1511.07277 2015)

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