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Nonlinear Isotope Shift in Yb^+ Search for Dark Matter

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Recently it has been proposed to search for particles outside the Standard Model (SM) in an intermediate mass range by means of optical precision isotope shift spectroscopy. We perform such a measurement on two S $\rightarrow$ D quadrupole transitions for five isotopes of Yb $^+$ with zero nuclear spin with an accuracy of $\sim$ 300Hz. The corresponding King plot shows a 10 $^{-6}$ deviation from linearity at the 3.3 σ uncertainty level. A nonlinearity in the King plot can indicate a new-boson-mediated force beyond the Standard Model (SM), or arise from higher-order corrections within the SM. We identify the isotopic shape change of the nuclear charge distribution as a possible source of nonlinearity within the SM. We also report on progress towards more precise measurements on the quadrupole transitions and on a highly forbidden octupole transition that can be used to distinguish between effects within and outside the SM.