NEW METHOD TO DETERMINE NUCLEAR CHARGE RADIUS BASED ON EUV SPECTROSCOPY OF NA-LIKE IONS

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Nuclear charge radii are a fundamental property that is key to understanding nuclear structure. Their measurement with electron scattering and muon spectroscopy is accurate but limited to stable isotopes. Though relative shifts in charge radii along isotope chains from optical isotope shifts measurements are very precise, many-electron atomic calculations can contribute to systematic offsets. Transition energies of Na-like ions are particularly sensitive to nuclear size and their simple electronic structure results in highly accurate atomic-structure calculations. A new method based on EUV spectroscopy of Na-like ions was implemented to measure the isotope shift of Na-like D1 (3s - $3p_{1/2}$) transitions between ^{124}Xe and ^{136}Xe isotopes using the EBIT facility at the National Institute of Standards and Technology. The mass-shift and the field-shift coefficients were calculated with enhanced precision by RMBPT and MCDHF methods. Comparison of the measured shift with these atomic-structure calculations was used to determine the variation in mean-square nuclear charge radius to be 0.269(42) fm^2, which agrees with previous measurements. The new method requires much smaller sample size than conventional methods, making it ideal to take first measurements of short-lived radioactive isotopes.