Collinear Laser Spectroscopy of Helium-like $^{12-14}C^{4+}$

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Light helium-like systems are ideal test cases for nuclear and atomic structure calculations as they exhibit a greatly varying nuclear structure and are accessible for high-precision ab-initio calculations. In an ongoing effort, it is planned to determine absolute and differential nuclear charge radii, R_C and $\delta\langle r^2\rangle$, of the light elements Be to N by purely using collinear laser spectroscopy and non-relativistic quantum electrodynamics calculations in the helium-like ions. As a first step, the $1s2s\,^3S_1 \rightarrow 1s2s\,^3P_J$ transitions in $^{12-14}C^{4+}$ were determined using the Collinear Apparatus for Laser Spectroscopy and Applied Science (COALA) at the Technical University of Darmstadt. Absolute and relative nuclear charge radii were extracted and compared to other experimental and theoretical results. In those measurements a significant splitting isotope shift (SIS) was observed. It is compared to the theoretical SIS, which is determined by the relativistic finite nuclear mass and recoil contributions to the energy [1], which provides a clear test of the experimental accuracy.

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References

[1] L.-M. Wang et al., *Phys Rev. A* **95**, 032504 (2017).