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Charge Radii of Light Isotopes from Laser Spectroscopy of He-Like Atomic Systems

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Light nuclei exhibit many facets of nuclear structure, like halos and clustering, and are accessible for *ab-initio* nuclear structure calculations. The atomic structure of few-electron systems is well understood; it allows for accurate calculations of mass-shift and field-shift factors in non-relativistic quantum electrodynamics calculations (NR-QED) to extract precise nuclear charge radii from the measurement of transition frequencies and isotope shifts. We have started to determine absolute and differential charge radii, R_c and $\delta\langle r^2\rangle$ of the light elements from Be to N using collinear laser spectroscopy. Helium-like ions of these species provide laser-accessible atomic transitions that can be calculated with the required accuracy in the NR-QED approach. As a first step, the $1s2s\,^3S_1 \rightarrow 1s2p\,^3P_J$ transitions in $^{12,13,14}\mathrm{C}^{4+}$ were determined using the Collinear Apparatus for Laser Spectroscopy and Applied Science (COALA) at the Technical University of Darmstadt. This represents the first optical charge radius measurements in the carbon isotope chain and will be the starting point for the necessary improvement of charge radii of the light-mass nuclei.

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