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Laser Spectroscopic Determination of the Nuclear Charge Radius of ^{6}He and ^{8}He P. MUELLER, L.-B. WANG, K. BAILEY, J.P. GREENE, D. HENDERSON, R.J. HOLT, R.V.F. JANSSENS, C.L. JIANG, Z.-T. LU, T.P. O'CONNOR, R.C. PARDO, K.E. REHM, J.P. SCHIFFER, X.D. TANG, Argonne National Laboratory, G.W.F. DRAKE, University of Windsor — Laser spectroscopic measurements of atomic isotope shifts provide unique access to the nuclear charge distribution of short-lived isotopes. The isotopes of interest for this study are ^{6}He ($t_{1/2}$ = 807 ms) and ^{8}He ($t_{1/2}$ = 119 ms), which exhibit a loosely bound neutron halo around an α-like core. Charge radii measurements of both isotopes provide corroboration for their halo structure and test nuclear structure theories of light nuclei. We have performed high-resolution laser spectroscopy on individual ^{6}He atoms captured in a magneto-optical trap. This technique enabled us to accurately measure the atomic isotope shift between ^{6}He and ^{4}He in the $2^3S_1 \rightarrow 3^3P_2$ transition. Based on this result and precision atomic theory calculation of this two electron system, the root-mean-square charge radius of the ^{6}He nucleus could be determined to be 2.054(14)fm [1]. Currently, we are working to expand this technique to also measure ^{8}He and we will report on first results from a ^{8}He production experiment at the ATLAS facility at Argonne. [1] L.-B. Wang *et al.*, PRL 93, 142501 (2004).
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Peter Mueller
Argonne National Laboratory

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