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Magnetic trapping of circular Rydberg atoms[1] DAVID ANDERSON, ANDREW SCHWARZKOPF, GEORG RAITHEL, University of Michigan — Circular Rydberg atoms [1] exhibit a unique combination of properties: long lifetimes ($\sim n^5$), large magnetic moments and angular momenta ($|m| = \ell = n-1$), and no first order Stark shift. Here, n, ℓ and m are the principal, orbital and magnetic quantum numbers, respectively. Several of these features have made circular Rydberg atoms attractive for a number of applications including photon-atom interaction [2] and Rydberg interaction experiments. We present here the realization of a magnetic trap for circular Rydberg atoms. The Rydberg-atom trap is characterized using state-selective electric-field ionization, direct spatial imaging of the atom distributions and time-of-flight analysis of the ion signal. At room temperature, we observe 70 percent of the trapped atoms remaining after 6ms. We measure an increase of the center-of-mass trap oscillation frequency by the expected factor of $\sqrt{|m|}$. Simulations of the state-evolution of circular-state atoms in our magnetic trap, held at 300K radiation temperature, are performed and results are in good agreement with the observed phenomena.

[1] Randall G. Hulet and Daniel Kleppner, PRL, **51**, 1430-1433 (1983),
[2] M. Brune et al., PRL, **77**, 4887-4890 (1996).

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