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532-nm intensity-modulated optical lattice for driving Rydberg-Rydberg transitions JAMIE MACLENNAN, KAITLIN MOORE, ANDIRA RAMOS, GEORG RAITHEL, Univ of Michigan - Ann Arbor — We present progress towards implementing an experiment to make a precision measurement of the Rydberg constant using circular-state Rydberg atoms. An independent measurement of the Rydberg constant will contribute to solving discrepancies in fundamental physics, most notably the "proton radius puzzle" [1]. The experiment relies on driving a circular to near-circular, n = 51 to 53 Rydberg-Rydberg transition. This transition was chosen because it is insensitive to nuclear charge distribution and first-order Stark and Zeeman effects, yielding less uncertainty in a Rydberg constant measurement. The Rydberg atoms are trapped in a 532-nm optical lattice, which is intensity-modulated so that its temporal harmonics drive the microwave-frequency transitions, so-called "ponderomotive spectroscopy." We have previously demonstrated ponderomotive spectroscopy using 1064-nm light modulated by a fiber-based electro-optic modulator (EOM) [2]. Here, the 532-nm light offers the benefit of a "magic wavelength" for the transition. Finding a method to prepare a tunable, high-power, intensity-modulated optical lattice at 532 nm presents a substantial challenge. Here, we report on progress in overcoming this challenge as well as on other recent experimental developments.

[1] R. Pohl, et al., Nature, 466, 213 (2010).
[2] K.R. Moore, S.E. Anderson, G. Raithel, Nat. Commun., 6 (2015).

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