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Enhanced apparatus for AC Zeeman experiments with ultracold potassium[1] ANDREW ROTUNNO, SHUANGLI DU, CHARLES FANCHER, ANDREW PYLE, SETH AUBIN, William Mary Coll — Ultracold atomic potassium is an excellent candidate for studies of the AC Zeeman force, due to small hyperfine splittings. These experiments require a sufficient sample of potassium near an atom chip supporting RF currents, and an RF source which can make rapid phase-continuous frequency sweeps for fast manipulation of spin states. We present progress on the construction of laser amplifier system for improved laser cooling and trapping of potassium, development of a frequency-agile RF source, and research on RF-capable atom chips. The laser amplifier system consists of two tapered amplifiers for producing 0.4 W of 767 nm light, with a goal of collecting 10^7 potassium atoms at 100 μK, which will then be cooled sympathetically with ultracold rubidium. We have constructed a direct digital synthesizer (DDS) to produce 1-400 MHz with Hz-level linewidth and noise level below -60dBc, and the ability to produce fast 100μs frequency sweeps. We are investigating atom chip designs for supporting large RF currents. Immediate applications include AC Zeeman potentials and traps for atom interferometry, and quantum many-body physics.

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