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Trapping ultracold dysprosium: A highly magnetic gas for dipolar physics

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Ultracold dysprosium gases, with a magnetic moment ten times that of alkali atoms and equal only to terbium as the most magnetic atom, are expected to exhibit a multitude of fascinating collisional dynamics and quantum dipolar phases, including quantum liquid crystal physics. We report the first laser cooling and trapping of half a billion Dy atoms using a repumper-free magneto-optical trap (MOT) and continuously loaded magnetic confinement, and we characterize the trap recycling dynamics for bosonic and fermionic isotopes. The first inelastic collision measurements in the few partial wave, 100 uK–1 mK, regime are made in a system possessing a submerged open electronic f-shell. In addition, we observe unusual stripes of intra-MOT <10 uK sub-Doppler cooled atoms. We will also discuss progress toward narrow-line cooling Dy to the 1 uK regime.