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Progress toward a high-performance ultracold dysprosium apparatus for quantum simulation experiments WILLIAM LUNDEN, MICHAEL CANTARA, LI DU, PIERRE BARRAL, ALAN O. JAMISON, WOLFGANG KETTERLE, MIT — Dysprosium, which possesses both the largest magnetic dipole moment of any atomic species and a variety of closed transitions compatible with standard laser cooling techniques, has in recent years proven itself to be a powerful platform for ultracold experimental studies of quantum systems with dipolar interactions. We report on the construction of a new apparatus for ultracold dysprosium experiments with a number of performance-enhancing design features, including low-noise custom control electronics and non-magnetic vacuum components and optomechanics. We also report on progress toward our first experimental goals: photoassociation spectroscopy of a trapped non-degenerate gas, which will offer valuable insight into the interatomic interaction potential; and a 2D spin-orbit coupled degenerate Fermi gas, which would be a first realization of 2D spin-orbit coupling in a system with dipolar interactions.

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