Progress toward the magneto-optical trapping of dysprosium SEO
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inois at Urbana-Champaign — We present details of an apparatus intended for the
magneto-optical trapping (MOT) of dysprosium, a lanthanide (rare-earth) atom
with an unsurpassed magnetic moment of 10 Bohr magnetons. The laser cooling
and trapping of highly magnetic atoms with complex level structure opens a new
frontier for ultracold dipolar physics, atom chip microscopy, and quantum informa-
tion processing. While lanthanides do not generally have closed optical transitions
beneficial for laser cooling, their large magnetic moments enable magnetic confine-
ment in a repumper-less MOT region while the excited state population recycles to
the ground state; such a scheme was recently successful for the laser cooling and
trapping of atomic Er [1], and Dy should be amenable to sub-μK laser cooling as
well. We discuss both the UHV system—including high temperature oven, Zeeman
slower, and trapping region—and the stabilized 421 nm laser system for the slower,