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Sub-second production of degenerate quantum gases of erbium[1]
ANNE HEBERT, AARON KRAHN, FURKAN OZTURK, LIN SU, GREGORY PHELPS, MARKUS GREINER, Harvard University — We present a scheme for fast, efficient production of Bose-Einstein condensates (BECs) and degenerate Fermi gases (DFGs) of erbium in an optical dipole trap. This versatile scheme produces pure BECs of 10^5 atoms in 900 ms, as well as DFGs of 10^5 atoms with a $T/T_F = 0.1$ in a few seconds. We start with very efficient loading into a two stage magneto-optical trap operating on two narrow transitions of erbium (190 kHz and 8 kHz), reaching sub-microKelvin temperatures. We then transfer the atoms into a dynamically tunable optical dipole trap, and apply a molasses cooling pulse to further increase the phase-space density of the cloud, which allows us to reach degeneracy with only a very short evaporation. Our result is promising for the field of degenerate quantum gases, as it significantly decreases the initial state preparation time. For quantum gas microscopy in particular, this is an order of magnitude improvement on state preparation time. This reduces the experiment's sensitivity to drifts and enables the study of questions that require a large number of statistics.

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