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Synthetic gauge fields in quantum gases of dysprosium[1] HUI ZHAI, Institute for Advanced Study, Tsinghua University, BENJAMIN LEV, Stanford University — To the toolbox of quantum gas-based many-body physics, highly magnetic atoms offer large, possibly non-perturbative, long-range dipolar interactions concomitant with extraordinarily large SU(2) spinors and novel atomic structure. We report on our recent proposal [1] to create a diversity of exotic quantum many-body phases–non-Abelian quantum magnets, high-spin quantum Hall states–using the unusual properties of dysprosium under the influence of large light-induced gauge fields, both Abelian and non-Abelian, to generate large synthetic magnetic fields and spin-orbit coupling. We will describe recent experimental progress as well as new results on the collisional properties of quantum dipolar Bose and Fermi gases of Dy, recently produced in our laboratory for the first time [2,3], including Feshbach resonance spectra [4].

[1] X. Cui, B. Lian, T.-L. Ho, B. Lev, and H. Zhai, Synthetic Gauge Field with Highly Magnetic Lanthanide Atoms, PRA 88, 011601(R) (2013).
[2] M. Lu, N. Burdick, S. Youn, and B. Lev, A Strongly Dipolar Bose-Einstein Condensate of Dysprosium, PRL 107, 190401 (2011).
[3] M. Lu, N. Burdick, and B. Lev, Quantum Degenerate Dipolar Fermi Gas, PRL, 108, 215301 (2012).
[4] N. Burdick, K. Baumann, M. Lu, and B. Lev, to be published.

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