Dipolar physics with ultracold atomic magnets

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Given their strong magnetic moment and exotic electronic configuration, rare-earth atoms disclose a plethora of intriguing phenomena in ultracold quantum physics. Here, we report on the first degenerate Fermi gas of erbium atoms, based on direct cooling of identical fermions via dipolar collisions [1]. We study the impact of the anisotropic character of the interaction following the re-thermalization dynamics of a dipolar Fermi gas driven out of equilibrium [2]. At the many-body level, we prove the long-standing prediction of a deformed Fermi surface in dipolar gas [3]. Finally, scattering experiments show a spectacularly high number of Fano-Feshbach resonances. This complexity, arising from the anisotropy of the interactions, escapes to traditional scattering models and requires novel approaches based on statistical analysis. Using the powerful toolset provided by Random-Matrix theory, we elucidate the chaotic nature of the scattering [4].

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