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Effects of the anisotropic dipole-dipole interaction in few-particle quantum systems GUNNAR ERIKSSON, JONAS C. CREMON, STEPHANIE M. REIMANN, Mathematical Physics, LTH, Lund University, P. O. Box 118, SE-22100 Lund, Sweden — Recent realizations of condensates of atoms with large magnetic dipole moments, ultracold gases of dipolar molecules and Rydberg atoms have made it possible to study systems with a long range and spatially anisotropic interaction. These special properties of the interaction is presumed to give rise to new and exotic phases and other many-body phenomena and they can be altered by changing the direction of the dipoles with e.g. an external field. For ultracold gases there is now also the possibility to access the few-particle regime. Combining these techniques, few-particle systems with the dipole-dipole interaction, resembling e.g. electrons in a quantum dot or nucleons in a nuclei, could be studied. We have performed exact diagonalization to systems of a few fermions interacting with the dipole-dipole interaction in a quasi-2D system. For such a system under rotation, the anisotropy of the interaction can be used to reveal the vortex structure in the particle density and the probability current (Phys. Rev. A 86, 043607). The anisotropy also allows the system to reduce the interaction energy by more exotic particle arrangements, which leads to new behavior that can be externally tuned.

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