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Simulation of spin effects with ultracold gases in optical traps

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Development of physics of ultracold atoms has opened unique possibility for realisation of R. Feynman's idea: to use simple quantum systems with desiered properties (amenable quantitative description and modeling) to describe more complex systems and phenomena. Particularly, in solid state physics one can mention the modeling of matter phase-transition with the ultracold atom simulator (realization of the Bose-Hubbard model). Another intriguing perspective in this diretion is a possibility to control of dipolar many-body phase. As an example, we discusse the use of dipolar confinement-induced resonances of ultracold gasses in waveguides for modeling tunable magnetic moment (or dipole-dipole) interactions.

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