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Fractional Quantum Hall Effect of Rydberg-Polaritons

FABIAN GRUSDT, MICHAEL FLEISCHHAUER, Department of Physics and Research Center OPTIMAS, TU Kaiserslautern, JOHANNES OTTERBACH, Physics Department, Harvard University, Cambridge, Massachusetts — Dark-state-polaritons (DSP) are bosonic quasiparticles arising in the interaction of light with 3-level atoms under conditions of electromagnetically induced transparency (EIT). They can be exposed to artificial magnetic fields, strong enough to enter the lowest Landau level regime [Otterbach et. al., Phys. Rev. Lett. 104 (2010)]. We take into account interactions between the DSPs via Rydberg dipole-dipole interactions and discuss the realization of the $\nu = 1/2$ -Laughlin state and its anyonic excitations (quasiholes) in such systems. The DSPs can be prepared in the correct total angular-momentum subspace by using orbital angular momentum light beams. A numerical and semi-analytical evaluation of the quasihole-gap is presented.

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