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**Excitons in cavity-embedded quantum dot lattices** MICHAL GROCHOL, CARLO PIERMAROCCHI, Department of Physics and Astronomy, Michigan State University — We investigate excitons and trions in a two-dimensional quantum dot lattice embedded in a planar optical cavity. The strong exciton (trion)-photon coupling is described in terms of polariton quasiparticles. First, we focus on Bragg polariton modes obtained by tuning the exciton and the cavity modes into resonance at high symmetry points of the Brillouin zone. The effective mass of these polaritons can be extremely small, of the order of $10^8\,m_0$ ($m_0$ is the bare electron mass) and makes them the lightest exciton-like quasiparticle in solids [1]. Second, we consider how disorder affects the properties of Bragg polariton modes. We focus on three kinds of disorder: (i) inhomogeneous exciton energy, (ii) inhomogeneous exciton-photon coupling, and (iii) deviations from an ideal lattice. It is found that in some cases weak disorder increases the light matter coupling and it leads to a larger polariton splitting [2]. Finally, each dot has one electron, and the electron spin determines the polarization of the cavity photon that couples to the dot. Such a "spin lattice" can be used for quantum information processing and we show that by using exciton detuning a conditional phase shift gate with high fidelity can be obtained [3]. [1] E. M. Kessler, et al., Phys. Rev. B **77**, 085306 (2008). [2] M. Grochol et al., Phys. Rev. B **78**, 035323 (2008). [3] M. Grochol et al., Phys. Rev. B **78**, 165324 (2008).

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