Exciton Dressing and Capture by a photonic Band Edge

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We demonstrate anomalous quantum dynamics of an exciton in a photonic band gap (PBG) - quantum well (QW) hetero-structure [1-3]. Within the engineered electro-magnetic vacuum of the PBG material, the exciton can propagate through the QW by the emission and re-absorption of virtual photons in additional to the conventional electronic hopping mechanism. When the exciton wavevector and recombination energy coincide nearly with a photonic band edge, the exciton kinetic energy is lowered by 1-10mev through coherent radiative hopping. This capture of the exciton by the photonic band edge is accompanied by strong electromagnetic dressing in which exciton's renormalized effective mass is many orders of magnitude smaller than in the absence of the PBG environment. The PBG material facilitates more strongly coupled and more robust exciton-polariton dressed states with longer lifetime than converntional semiconductor microcavities [4].

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