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Optical Manipulation of collective spin correlations in semiconductors with polarization squeezed vacuum ERAN GINOSSAR, YEHOSHUA LEVINSON, SHIMON LEVIT, QUANTUM OPTICS OF SEMICONDUCTORS COLLABORATION — We calculate the transfer rate of correlations from polarization entangled photons to the collective spin of a many-electron state in a two-band system. It is shown that when a semiconductor absorbs pairs of photons from a two-mode squeezed vacuum, certain fourth order electron-photon processes correlate the spins of the excited electron pairs of different quasi-momenta. Different distributions of the quantum Stokes vector of the light lead to either enhancement or reduction of the collective spin correlations, depending on the symmetry of the distribution. We find that as the squeezing of the light becomes non- classical, the spin correlations exhibit a crossover from being positive with a $\sim N^2$ (N is average photon number) scaling, to being negative with $\sim N$ scaling, even when N is not small. Negative spin correlations mean a preponderance of spin singlets in the optically generated state. We discuss the possibility to measure the collective spin correlations in a combined measurement of the Faraday rotation fluctuation spectrum and excitation density in a steady-state configuration.

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