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**Many-body interaction in semiconductors probed with 2D Fourier spectroscopy** MIKHAIL EREMENTCHOUK, MICHAEL LEUENBERGER, University of Central Florida, LU SHAM, University of California San Diego — A particular difficulty in studying many-body interactions in a solid is the absence of an experimental technique that can directly probe their key characteristics. We show that 2D Fourier spectroscopy provides an efficient tool for the measurement of critical parameters describing the effect of many-body interactions on the optical response of semiconductors. We develop the basic microscopic theory of 2D Fourier spectroscopy of semiconductors in the framework of the three-band model (heavy holes, light holes, and electrons). The theory includes many-body correlations nonperturbatively. We show, in particular, that 2D Fourier spectrum allows one to make a distinction between the diffraction on the gratings created by the heavy- and the light-hole excitons. We apply the theory to an analysis of the available experimental data. Based on this analysis we are able to deduce the relative contributions to four-wave mixing of the interaction between the excitons with different and the same helicities. Experiments providing more detailed information are suggested.

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