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Using 2D Fourier-transform spectroscopy to separate homogeneous and inhomogeneous line widths of heavy- and light-hole excitons in weakly disordered semiconductor quantum wells STEVEN CUNDIFF, ALAN BRISTOW, TIANHAO ZHANG, MARK SIEMENS, JILA, NIST and University of Colorado, RICHARD MIRIN, NIST-Boulder — Optical two-dimensional Fourier-transform spectroscopy is used to study the heavy- and light-hole excitonic resonances in GaAs quantum wells with weak structural disorder. Homogeneous and inhomogeneous broadening contribute differently to the two-dimensional resonance line shapes, allowing separation of homogeneous and inhomogeneous line widths. The heavy-hole exciton exhibits more inhomogeneous than homogeneous broadening, whereas the light-hole exciton shows the opposite. This situation arises from the interplay between the length scale of the disorder and the exciton Bohr radius, which affects the exciton localization and scattering. Utilizing this separation of line widths, excitation-density-dependent measurements reveal that many-body interactions alter the homogeneous dephasing, while disorder-induced dephasing is unchanged.

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