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Observation of the exciton in low-temperature-grown GaAs using four-wave mixing DANIEL WEBBER, LUKE HACQUEBARD, MURAT YILDIRIM, SAM MARCH, REUBLE MATHEW, ANGELA GAMOURAS, Dalhousie University, XINYU LIU, MARGARET DOBROWOLSKA, JACEK FURDYNA, University of Notre Dame, KIMBERLEY HALL, Dalhousie University — Low-temperature-grown (LT) semiconductors are the materials of choice in optoelectronic devices such as fast photodetectors and THz sources and detectors owing to their unique photoconductive properties tied to the presence of antisite defects . Recent experiments have provided insight into the carrier trapping processes responsible for the subpicosecond recovery times in these systems, as well as the relevance of band-tail transitions in the vicinity of the band gap; However, little is known about the coherent interband response in low-temperature-grown systems. Here we report the application of femtosecond four-wave mixing techniques to LT-GaAs. Our experiments reveal a clear response associated with bound excitons despite the absence of any such feature in linear spectroscopy studies on LT-GaAs. Experiments performed over a wide range of conditions indicate that carrier-carrier scattering dominates dephasing for carriers above the band gap, and that the exciton response tied to excitation-induced dephasing may be quenched in the presence of a prepulse with a sufficiently high fluence. Our findings provide new insight into the optical response of LT-GaAs in the ultrafast nonlinear regime applicable to the operating conditions of optoelectronic devices.

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