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State-resolved optical pumping and single exciton gain in CdSe quantum dots. RYAN COONEY, PATANJALI KAMBHAMPATI, SAMUEL SEWALL, D.M. SAGAR, McGill University — Optical gain in semiconductor quantum dots has been under intense investigation. Optical gain has been difficult to produce unless special geometries were employed such as thin films of CdSe quantum dots, or more recently, type II CdS/ZnSe core /shell structures. The prototypical CdSe quantum dots in dispersion typically show small gain even at extremely high carrier concentrations. The key problem is induced absorptions due to multi-exciton interactions which result in losses that cancel the expected gain. Our recent state-selective approach can be used to prepare initial excitonic states, which has yielded much insight on exciton relaxation dynamics. This approach was used here to generate some of the largest gains ever measured, at the lowest thresholds, for all sizes of CdSe quantum dots in dispersion. These results show that gain in quantum dots is general, if the system is driven correctly.

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