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Statistical Properties of Exciton Fine Structure Splittings and Polarization Angles in Quantum Dot Ensembles MING GONG, Department of Physics, The Chinese University of Hong Kong, B. HOFER, E. ZALLO, 2 Institute for Integrative Nanosciences, IFW Dresden, Helmholtzstr, 20, D-01069 Dresden, Germany, R. TROTTA, Institute of Semiconductor and Solid State Physics, Johannes Kepler University Linz, Altenbergerstr. 69 A-4040 Linz, Austria, JUNWEI LUO, 4National Renewable Energy Laboratory, Golden, Colorado 80401, USA, ALEX ZUNGER, University of Colorado, Boulder, Colorado 80401, USA, O.G. SCHMIDT, Institute for Integrative Nanosciences, IFW Dresden, Helmholtzstr, 20, D-01069 Dresden, Germany, CHUANWEI ZHANG, 4National Renewable Energy Laboratory, Golden, Colorado 80401, USA, CHUANWEI ZHANG GROUP COLLABORATION, ALEX ZUNGER GROUP COLLABORATION, O. G. SCHMIDT GROUP COLLABORATION — We propose an effective model to describe the statistical properties of exciton fine structure splitting (FSS) and polarization angle of quantum dot ensembles (QDEs). We derive the distributions of FSS and polarization angle for QDEs and show that their statistical features can be fully characterized using at most three independent measurable parameters. The effective model is confirmed using atomistic pseudopotential calculations as well as experimental measurements for several rather different QDEs. The model naturally addresses three fundamental questions that are frequently encountered in theories and experiments. The answers to these fundamental questions yield a completely new physical picture for understanding optical properties of QDEs.

Ming Gong
Department of Physics, The Chinese University of Hong Kong

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