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Controlling the Optical Properties of Self-Assembled Quantum Dots Using External Strain M. ZIELINSKI, NRC, Ottawa, W. JASKOLSKI, UMK, Torun Poland, G. W. BRYANT, J. DIAZ, NIST, Gaithersburg, J. AIZPURUA, DIPC, San Sebastian — Passive control of the optics of self-assembled quantum dots is achieved by controlling dot size, shape and composition via growth. Local strain from lattice mismatch between the dot and barrier influences the electronic properties. Dynamical control could be achieved via imposed external strain to change level degeneracies, polarize transitions, or modify coupling between dots. Moreover dots could be coupled to bending modes to optically cool nanomechanical oscillators to the quantum limit. To understand the impact of externally imposed strain on the electronic states of self-assembled dots, we use a tight- binding theory of dots that incorporates local strain from lattice mismatch and externally imposed strain from applied stressors or the bend in a nanomechanical oscillator. Energy level shifts depend on the position of the dot in a nanomechanical oscillator and how the oscillator is bent. Energy levels can red-shift and blue-shift depending on how the external strain is imposed. Shifts in the electronic levels due to different bending modes are determined. This allows us to assess how much active control is possible.

Garnett Bryant
NIST

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