Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Quadrupolar spectra of nuclear spins in strained InGaAs quantum dots[1] CEYHUN BULUTAY, Bilkent University — Self-assembled quantum dots (QDs) are born out of lattice mismatched ingredients where strain plays an indispensable role. Through the electric quadrupolar coupling strain affects the nuclear spins. To guide upcoming single-QD nuclear magnetic resonance (NMR) as well as dynamic nuclear spin polarization experiments, a computational atomistic insight to the strain and quadrupolar field distributions will be presented. Among our findings, a high aspect ratio of the QD geometry enhances the quadrupolar interaction; inclined interfaces introduce biaxiality and the tilting of the major quadrupolar principal axis away from the growth axis; the alloy mixing of gallium into the QD enhances both of these features while reducing the quadrupolar energy. NMR spectra in Faraday and Voigt geometries are computed, unraveling in the first place the extend of inhomogeneous broadening and the appearance of the normally-forbidden transitions. Moreover, from the main extend of the NMR spectra the alloy mole fraction of a single QD can be inferred. In the presence of an external magnetic field, the borderlines between the quadrupolar and Zeeman regimes are extracted as 1.5 T for In and 1.1 T for As nuclei.

[1]Supported by TUBITAK with the Project No. 112T178

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Date submitted: 18 Oct 2012 Electronic form version 1.4