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# Elastic and Electric Field Effects of a Quantum Dot Nucleated on the Edge of a Threading Dislocation

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III-nitride based layers generally contain many threading dislocations that can be characterized by continuous displacement fields arising from a crystallographic half-plane inclusion [1]. It is observed by experiment that the atomic half-plane terminates at the edge of the quantum dot and does not propagate into the dot and the influence of the strain field around the dislocation core is assumed to provide preferential geometric conditions for the nucleation of the QD at this site [2]. The spontaneous electrostatic polarization found in wurtzite crystals tends to orientate the electrostatic potential with a dipole parallel to the crystal *c* axis [3]. This dominates the electronic and optical properties of isolated quantum dots that is further modified by the built-in piezoelectric field [4]. Nevertheless, the presence of long-range elastic and electric fields appearing in the proximity of a negatively charged dislocation line [5,6] lead to the expectation that additionally these fields will affect the optoelectronic properties of the QD. The quantification of these effects remain an open question. To investigate these phenomena, a model of a hexagonal-based GaN/AlN QD nucleated at the edge of a TD is studied by solving a fully coupled elastic-electric problem in an adaptive finite element basis. Results are presented in terms of the quantitative and qualitative differences in these fields due to the inclusion of a charged-core dislocation.

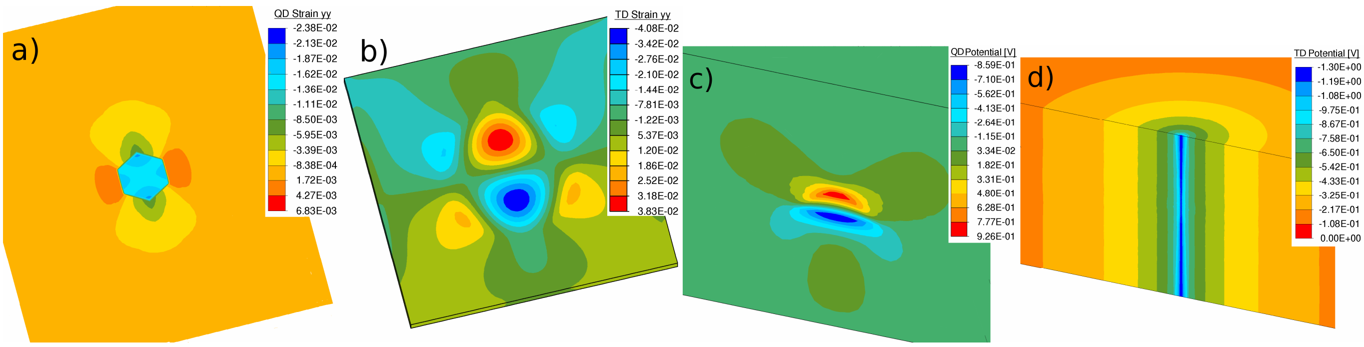


Fig. Elastic strain and electrostatic potential respectively in the vicinity of: (a,c) a QD and (b,d) a TD.

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