Inversion of permanent exciton dipole moment in self-assembled In(Ga)As quantum dots using nonlinear piezotronic effect

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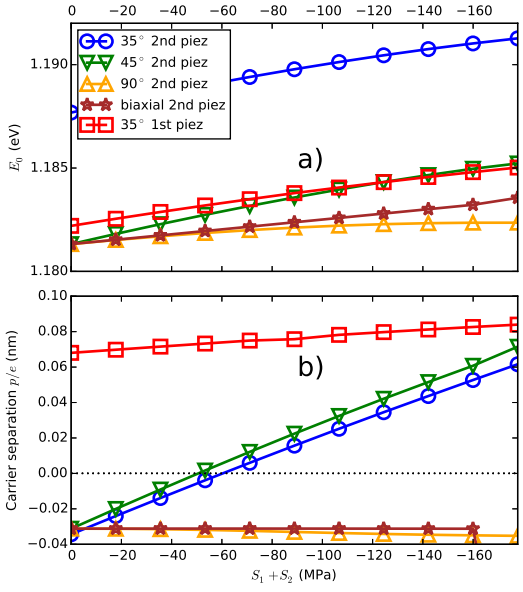
We show tuning of the electric dipole moment of excitons confined in self-assembled In(Ga)As quantum dots by anisotropic biaxial stress up to complete erasure of the dipole and inversion of its sign. A careful inspection of the current-voltage characteristics of our diode-like device reveals a systematic and sizable change of its built-in potential up to 110 mV with applied stress. We attribute this effect to piezoelectricity and present a simple model allowing us to deduce fairly precisely the magnitude of the applied stress from the shift of the current onset. Furthermore, by self-consistent k.p calculations we single out the effect of various contributions to the strain-induced changes of the dipole moment in our QDs and find a dominant influence of the nonlinear piezoelectricity, importance of which in QD-physics has been theoretically recognized but it proved to be difficult to single out experimentally.



[1] https://arxiv.org/abs/1702.08314