

Resonant magnetotunneling spectroscopy of strained elliptical Si/SiGe quantum dots

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We have been studying the interplay between mechanical strain relaxation and electronic properties of inhomogeneously strained Si/SiGe quantum dots.¹ Since strain relaxation is not only determined by the size, but also by the geometry, during the last year we fabricated elliptical and figure-eight double quantum dots, and used magnetotunneling spectroscopy to study their transport properties. Unlike cylindrical dots, these structures no longer have azimuthal symmetry and hence require more complex 3D strain relaxation modeling, which has been carried out, as shown in Fig. 1(b). The fine structure in the tunneling characteristics and its evolution in magnetic field B makes it possible to infer the lateral carrier confinement due to inhomogeneous strain, corroborating the relaxation modeling. As an example, the merging of the fine structure $I(V,B)$ peaks at higher B , shown in Fig. 1(c), agrees with the magnetic depopulation of local potential minima along the long elliptical axis of Fig. 1(b).²

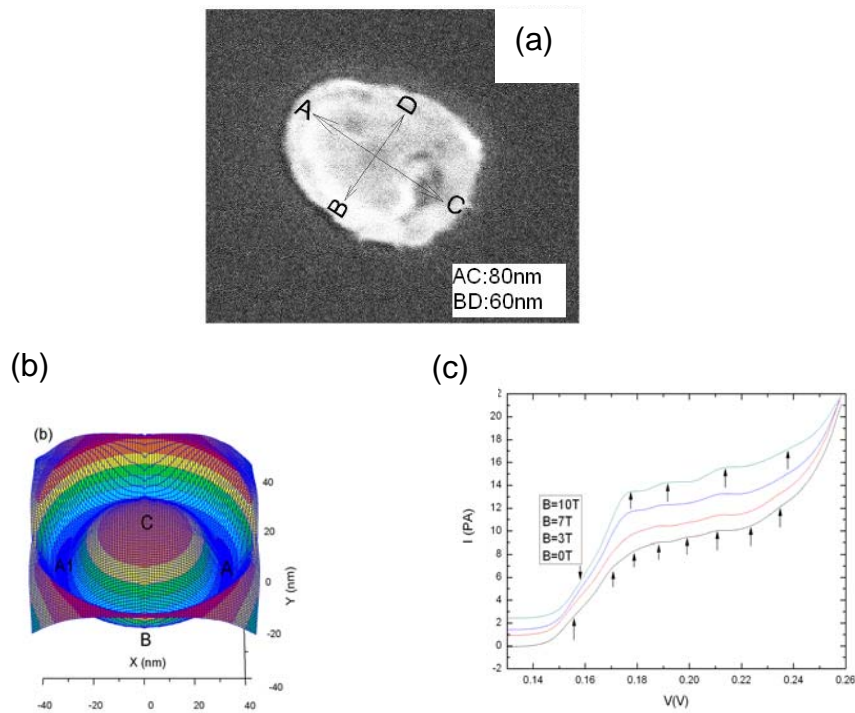


Fig. 1: (a) SEM top view of an elliptical quantum dot (Al top contact, which serves as an etch mask for the Si/SiGe heterostructure); (b) inhomogeneous strain in the plane of the SiGe quantum well, calculated by 3D finite element simulation; (c) $I(V,B)$ characteristics at $T = 1.7$ K, showing the evolution of the peaks with magnetic field, including the magnetic depopulation of strain-induced local potential minima at $B > 5$ T.

¹ Jun Liu, A. Zaslavsky, and L. B. Freund, *Phys. Rev. Lett.* **89**, 096804 (2002); *Phys. Rev. B (Rapid Comm.)* **66**, 161304 (2002).

² Guohua Wang, D. T. Tambe, A. Zaslavsky and V. Shenoy, "Resonant magnetotunneling spectroscopy of strained elliptical SiGe quantum dots", submitted to *Phys. Rev. B* (2005).