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Are quantum dots in unexpected locations due to strain? NEIL ZIMMERMAN, NIST, TED THORBECK, University of Wisconsin-Madison — It is a fairly common occurrence that, in top-gated Si quantum dots, the dots appear in reproducible but unexpected positions. For instance, sometimes a group will make gates in order to electrostatically generate tunnel barriers, but discover that the quantum dot is formed underneath the gate rather than between two barrier gates. We will discuss the possibility that such quantum dots arise from the mechanical strain induced by the gate. The model is simple: i) We simulate metal or polysilicon gates on top of a Si/SiO$_2$ wafer, and calculate the stress and strain from differential thermal contraction of the materials; ii) Using the fact that the energy of the Si conduction band depends on strain through the deformation potential, we then convert the strain modulation to a potential energy modulation. As an example, we find that, for a single Al gate, there is a potential well directly underneath the gate with the size of a few meV, in agreement with recent experimental results. We also show that polysilicon gates will not produce such strain-induced quantum dots.

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