We compare measurements with electrostatic simulations of the double quantum dot structure shown below: (a) poly depletion gates, (b) poly reoxidation, (c) A223 deposition, (d) Al top gate deposition.

Figure 5 above is similar to [B] but with symmetric biasing. The figure below is a cut along the blue line in [S] showing the conduction band shape in the region of the three barriers.

The second structure we examined is shown next. Only the west half of the QPC barrier shown below on the right figure was simulated and compared to the measurement with good agreement is observed.

The authors wish to acknowledge many useful discussions with Wayne Witzel, Erik Nielsen, and Rajib Rahman.

APPORXIMATION OF 0 KELVIN BARRIER SHAPE

One of the concerns with the electrostatic simulations is that at the temperature in the range of 1 Kelvin or below, the measurements are done, cannot be simulated using the commercial software. 50 Kelvin can be routinely simulated, and we were able to simulate as low as 15 Kelvin using extended precision. We did a simulation study to understand the error due to the difference between the simulated and measured temperatures. Taking a cut through the QPC barrier shown below on the left, we plotted electron density and conduction band simulated at 50K and at 19K. It was seen that the charge does not change much as the temperature is lowered. See below on the right.

However, the conduction band, shown below, does change appreciably as the temperature is decreased.

To approximate the low temperature conduction band we use a 0 Kelvin Fermi-Dirac distribution, which is a step function.

\[ E_F = \begin{cases} E_T & T \rightarrow 0 \\ E_F & \text{otherwise} \end{cases} \]

For \( T \rightarrow 0 \)

\[ F_T (E_B) = \int \left[ 1 - H (E_B - \frac{E_F}{k_B T}) \right] \, dE_B \]

\[ F_T (E_B) = \int \left[ 1 - \frac{E_B - \frac{E_F}{k_B T}}{k_B T} \right] \, dE_B \]

\[ a = 2.42 \times 10^{11} \text{cm}^{-2} \]

\[ E_F = E_V - \frac{Q_{Schottky}}{2.42 \times 10^{11} \text{cm}^{-2}} \]

The conduction band simulated at 15 Kelvin and the estimates calculated from the expression above using the charge densities simulated at 50 Kelvin and at 15 Kelvin are very close to one another. This is the justification for using the above expression with 50 Kelvin simulations of the charge density to estimate the low temperature conduction band.

The plot below on the right shows the 0 Kelvin conduction band from the cut shown on the left vs. QPC gate voltage.

The authors wish to acknowledge many useful discussions with Wayne Witzel, Erik Nielsen, and Rajib Rahman.