Compressibility measurements of the 0.7 structure in a one-dimensional quantum wire

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The conductance through a ballistic one-dimensional channel is quantised in units of $2e^2/h$. However, there is often also an extra conductance feature close to $0.7 \times 2e^2/h$, whose origins have been a subject of great debate. Many theories have been put forward to explain the so-called 0.7 structure, including spontaneous spin polarisation, the Kondo eect, and phenomenological spin-gap models, amongst others. The majority of experiments performed on 1D channels simply measure the conductance of the system, although notable exceptions include thermopower, shot noise, and scanning gate microscopy. All of these are inherently non-equilibrium measurements, unlike the thermodynamic compressibility. Very recently, high resolution measurements of the compressibility of a single 1D wire were performed, which for the first time were able to resolve magnetic field induced spin-splitting of subbands in the compressibility signal [1].

In this work we measure the compressibility signal due to the 0.7 structure for different temperatures and magnetic fields, and compare it with the predictions of various models. We show that compressibility measurements are a very powerful tool to probe the 0.7 structure, since models which predict very similar conductance characteristics give rise to very different responses in the compressibility.

[1] L.W. Smith, A. R. Hamilton, K. J. Thomas, M. Pepper, I. Farrer, J. P. Griffiths, G. A. C. Jones, and D. A. Ritchie, Phys. Rev. Lett. **107**, 126801 (2011).