# Thermodynamics and quantum anomaly in 2D atomic Fermi gases

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We present an experimental study of the thermodynamic properties of interacting Fermi gases in the crossover from 2D to 3D. In the 2D regime, we measure the equation of state for gases in the normal phase with a range of interaction strengths which show distinct features associated with the presence of a two-body bound state in 2D. We also use collective oscillations, specifically the radial breathing mode frequency, as a probe of the thermodynamic character through the dimensional crossover. The frequency of this mode is set by the equation of state whose polytropic forms are known the 2D and 3D limits. Furthermore in 2D, the Hamiltonian for a gas with delta-function interactions shows a classical scale invariance. However, a renormalised quantum treatment introduces a length scale that breaks the scale invariance leading to a so-called quantum anomaly. Our measurements of the collective mode frequency in the 2D regime lie above the scale-invariant prediction for a range interaction strengths, consistent with the existence of the quantum anomaly.