Looking between dimensions for modulated superfluidity: FFLO in the 1D-3D crossover

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Abstract

In the mid 60's, theoretical physicists came to the conclusion that a strong magnetic field can lead to a superconducting state where magnetism and superconductivity are interleaved on the nano-scale: tidal wave like domain walls spontaneously form in the superfluid order, trapping unpaired spins. Over the past 50 years, our theoretical understanding of this proposal has greatly advanced, yet we still have not found definitive experimental evidence of the modulated superconducting state (also known as the FFLO state, after the initials of the theorists who anticipated it). In 2010, experimentalists at Rice University found thermodynamic evidence of a fluctuating version of this state in arrays of tight 1D traps [Liao et al. Nature 467, 567 (2010)]. This fluctuating order can be stabilized by reducing the barriers between the 1D traps, allowing the fermions to hop between them. I will describe the physics of this 1D to 3D crossover, and explain how the long-sought after modulated state may be definitively observed.

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