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(G*) Triangular Pair-Density-Wave in Confined Superfluid 3He

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The prototypical superfluid, Helium-4 (^{4}He), transitions to its superfluid state below ~2 K. In contrast, its isotopic counterpart Helium-3 (^{3}He) has a transition temperature of ~2 mK. This thousand-fold disparity is due to the nature of the superfluid transition; while ^{4}He Bose condenses directly, the fermionic ^{3}He atoms must first form composite bosons through Cooper pairing. The p-wave, spin-triplet pairing of the ^{3}He atoms gives rise to many possible superfluid phases, though only two distinct phases are realized in the bulk.

Recent experimental and theoretical advances have suggested that a third phase emerges when superfluid ^{3}He is confined to a slab — a pair-density-wave (PDW) phase. Analogous to a supersolid, the PDW phase is characterized by the spontaneous breaking of translational symmetry that coexists with superfluid order. The precise spatial structure of this "superfluid crystal" has been the subject of ongoing debate: existing theories favor a unidirectional PDW, the stripe phase, while recent nuclear magnetic resonance (NMR) experiments seem to indicate a two-dimensional PDW with square or hexagonal symmetry. In this talk, I will outline a mechanism, based on Landau's theory of weak crystallization, which stabilizes a two-dimensional PDW with the hexagonal symmetry of a triangular lattice.

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