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Prof. Radzihovsky, Leo (University of Colorado): Fluctuations, stability, and phase transitions of Larkin-Ovchinnikov states: quantum liquid crystals

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Motivated by polarized Feshbach-resonant atomic gases, I will discuss the nature of low-energy fluctuations in the putative Larkin-Ovchinnikov (LO) state. Because the underlying rotational and translational symmetries are broken spontaneously, this gapless superfluid is a quantum smectic liquid crystal, that exhibits fluctuations that are qualitatively stronger than in a conventional superfluid, thus requiring a fully nonlinear description of its Goldstone modes. Consequently, at nonzero temperature the LO superfluid is an algebraic phase even in 3d. It exhibits half-integer vortex-dislocation defects, whose unbinding leads to transitions to a superfluid nematic and other phases. In 2d at nonzero temperature, the LO state is always unstable to a charge-4 (paired Cooper-pairs) nematic superfluid. I expect this superfluid liquid-crystal phenomenology to be realizable in imbalanced resonant Fermi gases trapped isotropically.

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