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Unconventional Phases of Attractive Fermi Gases in Synthetic Hall Ribbons SUDEEP GHOSH, Department of Physics, Indian Institute of Science, India, SEBASTIAN GRESCHNER, Leibniz University of Hannover, Germany, UMESH YADAV, Lovely Professional University, India, TAPAN MISHRA, Indian Institute of Technology, Guwahati, India, MATTEO RIZZI, University of Mainz, Germany, VIJAY B. SHENOY, Department of Physics, Indian Institute of Science, India — A novel way to produce quantum Hall ribbons in a cold atomic system is to use M hyperfine states of atoms in a 1D optical lattice to mimic an additional "synthetic dimension". A notable aspect here is that the SU(M) symmetric interaction between atoms manifests as "infinite ranged" along the synthetic dimension. We study the many body physics of fermions with attractive interactions in this system. We use a combination of analytical field theoretic and numerical density matrix renormalization group (DMRG) methods to reveal its rich ground state phase diagram, including unconventional phases such as squished baryon fluids. Remarkably, changing the parameters entails novel crossovers and transitions, e. g., we show that increasing the magnetic field (that produces the Hall effect) may convert a "ferrometallic" state at low fields to a "squished baryon superfluid"(with algebraic pairing correlations) at high fields. We also show that this system provides a unique o pportunity to study quantum phase separation in a multiflavor ultracold fermionic system.

Sudeep Ghosh
Department of Physics, Indian Institute of Science, India

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