**Fluctuation theory of Rashba Fermi gases: Gaussian and beyond**[1]

VIJAY B. SHENOY, Indian Institute of Science Bangalore, JAYANTHA P. VYASANAKERE, Tumkur University — Fermi gases with generalized Rashba spin orbit coupling induced by a synthetic gauge field have the potential of realizing many interesting states such as rashbon condensates and topological phases. Here we address the key open problem of the fluctuation theory of such systems and demonstrate that beyond-Gaussian effects are *essential* to capture finite temperature physics of such systems. We obtain their phase diagram by constructing an approximate non-Gaussian theory. We conclusively establish that spin-orbit coupling can enhance the exponentially small transition temperature ($T_c$) of a weakly attracting superfluid to the order of Fermi temperature, paving a pathway towards high $T_c$ superfluids.

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