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Mean field phase diagram of a two dimensional electron liquid with Rashba spin-orbit

STEFANO CHESI, GABRIELE GIULIANI, Purdue University — By a combination of analytic and numerical techniques we have mapped out the mean field phase diagram of a two dimensional electron liquid in the presence of Rashba or Dresselhaus spin-orbit. Although inhomogeneous solutions can be found that minimize the total energy, we have carried out a systematic study of the spatially homogeneous phases in the (r_s, α) diagram (with r_s the density parameter and α the strength of the spin-orbit coupling). The scenario is intriguing for a number of broken symmetry states have been unraveled that can be characterized by suitable momentum space occupation numbers $n_{\mathbf{k}}$ and local spin quantization axes $\hat{s}_{\mathbf{k}}$. While at high densities the system is as expected paramagnetic, at lower densities (or larger α values) markedly different ferromagnetic phases exist with spontaneous polarization oriented perpendicular or parallel to the plane of motion that are characterized by non trivial spin textures in momentum space. Of particular interest is a phase transition between an isotropic paramagnetic state to an anisotropic ferromagnetic one that occurs in the large α limit. The relation between the various phase transitions and the differential instabilities signaled by the in plane and out of plane spin susceptibilities will be discussed.

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