Fermi liquid in a two-dimensional electron system with Rashba spin-orbit coupling

Vitalii Dugaev [1], Evgeny Sherman [2], Denis Maryenko [3], Arthur Ernst [4]

[1] *Department of Physics and Medical Engineering, Rzeszów University of Technology, Rzeszów, Poland*
[2] *Department of Physical Chemistry, University of the Basque Country, Bilbao, Spain*
[3] *RIKEN Center for Emergent Matter Science, Wako, Japan*
[4] *Institute for Theoretical Physics, Johannes Kepler University, Linz, Austria*

We consider the effect of strong Coulomb interaction on electron energy spectrum of two dimensional electrons with Rashba spin-orbit coupling. In a self-consistent RPA approximation, the electron-electron interaction leads to corrections to the effective mass and Rashba coupling constant. Correspondingly, the electron effective mass increases whereas spin-orbit coupling decreases when the electron density gets smaller. In the regime of large Wigner-Seitz parameter $r_s >> 1$, one can use the Landau theory of Fermi liquid, which allows to establish some relations between the effective mass and Rashba coupling.

Our results are used to explain recent experimental results [1] on a ZnO/ZnMgO structure with strongly correlated 2D electrons at the interface.

[1] D. Maryenko, M. Kawamura, A. Ernst, V.K. Dugaev, E.Ya. Sherman, M. Kriener, M.S. Bahramy, Y. Kozuka, and M. Kawasaki, *Nat. Commun.* **12**, 3180 (2021).

Acknowledgements: This work was supported by the National Science Center in Poland as a research project No. DEC-2017/27/B/ST3/02881. A.E. acknowledges financial support from the DFG through priority program SPP1666 (Topological Insulators), SFB-TRR227, and OeAD Grants No. HR 07/2018 and No. PL 03/2018. E.Y.S. acknowledges support by the Spanish Ministry of Science and the European Regional Development Fund through PGC2018-101355-B-I00 (MCIU/AEI/ FEDER, UE) and the Basque Country Government through Grant No. IT986-16.