Phys635, MBQM II-Semester 2022/23, Tutorial 6, Wed 12.4.

Stage 1 Following the procedure of the lecture, calculate the energy of hole or particle excitations in a Fermi liquid (homogeneous system as in lecture) to first order perturbation theory. Then take their energy relative to the unperturbed Fermi sea. Make a graph of particle/hole energy as a function of k and discuss your results.

Stage 2 Cooper pairs

    (i) Understand and discuss the cartoon picture of the cooper pairing mechanism given in the lecture.

    (ii) Understand and discuss the two-body cooper pair calculation given in the lecture.

Stage 3 If we covered it in the lecture: discuss the following:

    (i) Why are attractively interacting degenerate Fermions fundamentally different from repulsive ones?

    (ii) What is a cooper pair?

    (iii) What is the BCS state?

    (iv) Why/when are degenerate Fermi gases superfluid?

Stage 4 Do any leftover items from earlier tutorials that you have not yet covered or would like to revise.