

Physics 133 Final Project (May 7th)

Due by 11:59 PM on Friday 9 AM, June 5th

Instruction:

Instead of a final exam, during the last week of class you are required to read literatures and write a final report. You can choose one of the following topics for your report.

The report should be single spaced with 11 point Times New Rome font. It should be at least 6 pages long. If you want to include figures into your report, please limit the number of figures to 3. The report is due by 11:59 PM on Friday 9 AM, June 5th. Please email your report (word or .pdf format) to xia.jing@uci.edu by that deadline. Do include your name, email address and student ID in the header of your report.

Topic 1.

Quantum Hall effect in 2D free electron gas. Free electron gas in 2D subject to a strong magnetic field will exhibit integer quantum Hall effect due to Landau level quantization. Please read the references below and write in your report:

- 1) The mechanism for quantization of Hall conductivity.
- 2) Why is the quantum Hall effect in graphene different from that in GaAs/AlGaAs? (hint, they have different dispersion relations.)

References:

1. Experimental observation of the quantum Hall effect and Berry's phase in graphene, Nature 438, 201-204 (10 November 2005)
2. Kittel (textbook) page 498-501

Topic 2.

Antiferromagnetism and Ferrimagnetism.

Due to different signs of exchange J and sublattice configuration, antiferromagnetism and ferrimagnetism can occur instead of ferromagnetism. Weiss model, as discussed in class, can be used to describe these two phenomena too. Please write in your report:

- 1) How to obtain the exact solution to the Weiss model. (ref. 2 below)
- 2) Use the Weiss model to describe antiferromagnetism and Ferrimagnetism.

References:

1. Kittel (textbook) page 340-352
2. M. A. B. Whittaker, American Journal of Physics 57, 45 (1989)