

Assignment 4

Course: *Quantum Many-Body Computation (PHYS8202)* – Prof. Zi Yang Meng

Tutor: Mr. Min Long, Mr. Shibo Shan

Due date: 10th December, 2025

Write an essay on a topic of your interest

Throughout this semester, we have studied basic knowledge of the Hubbard model and the Heisenberg model. Through the mean-field analysis and the exact diagonalization calculations, one sees that even such simple models actually contain very rich physics. For the last assignment, we invite you to write a short essay on any topic of interest that has been discussed during the lectures.

The possible content of such an essay can be

1. Some derivation and simulation you have worked through on your own and find it worthwhile to share your understanding with us;
2. Some references (research articles such as the paper by Hirsch, or those mentioned in your notebooks) that you actually read and understood, and you feel like explaining your understanding along with the derivation and simulation you learned from the lecture;
3. Some books (such as Fazekas) whose chapters (Chap.4,5,6 of Fazekas) you have truly read (after the repeated reminders of the teacher) and also understood, and you can write down your understanding along with some derivation or simulation of our lecture.

There is no length requirement for this essay, but the content must be complete, with the scientific question, solution, **your own understanding**, references, etc. However, direct copy from the references, or from AI tools, is not welcome.