Final Projects

project 1 Consider the harmonic oscillator

$$L = \frac{1}{2} m \dot{x}^2 - \frac{1}{2} m \omega^2 x^2$$

(a) Evaluate the ground state energy E_0 in Monte Carlo path integral

(b) Plot the ground state probability distribution and compare with the expected analytic form

(c) Evaluate the energy E_1 of the first excited state. Can you detect a change in the electron probability distribution?

(d) Calculate $\langle E(\theta) \rangle$ at finite temperature θ and compare with the expected analytic form as a function of temperature θ. Find the classical and quantum regime

project 2 Anharmonic double well potential

$$L = \frac{1}{2} m \dot{x} - a\left(x^2 - b^2\right)^2$$

(a) Evaluate the ground state energy E_0 in Monte Carlo path integral and the first excited state E_1

(b) Plot the ground state probability distribution

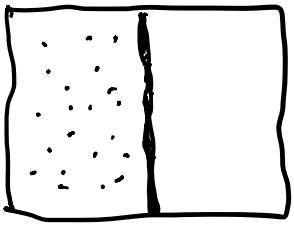
(c) Plot $E_1 - E_0$ as a function of the barrier height

project 3 2 dimensional harmonic oscillator with 4 parts (a) - (d) like in project 1

project 4

ideal gas in box with wall partition removed

2 dim



$pV = RT$

project 5

2 dim Ising model

calculate the specific heat as a function of temperature