

FYS4411/9411, MARCH 30, 2023

## Project 1

- Monte Carlo Markov Chain
  - sampling rule:
    - Metropolis-Hastings
    - importance sampling
  - implementing Boson trial wf with and without interaction
  - calculate Energy
  - — — — one body density
- Optimization methods
  - GD (Gradient descent)
  - SGD, Steepest descent...
- Resampling methods
  - post analysis, Blocking method
  - Good estimate of  $\sigma^2$  and STDdev.
- High-performance computing
  - IN4200
  - vectorization
  - MPI and open MP
    - ↙ Distri buted
    - ↘ shared memory
    - ↘ shared memory

## Project 2

- ④ extend **P1** to include fermions, reuse **P1** but change trial wf,
- ④ Deep learning.  $\Psi_T \Rightarrow$  neural network. Extend **P1** by replacing  $\Psi_T$  with a Neural network.
- Time-dependent mean field, hartree-Fock/DFT Dynamics of many-body systems
- Many-body methods (FYS4420) coupled cluster theory, MBPT, ...
- Quantum computing (FYS5149)
- .... suggestions from you.