

**ASSIGNMENT (2/3/2023) "Monte Carlo – Metropolis method"**

**Due date:** 1 week 9/3/2023

**Option 1:**

Modify any of the codes for the Monte Carlo simulation of the Ising model to implement one or several of the following improvements:

- Effect of the initial conditions. Start from a given initial condition different from random (for example all spins up or down or a large domain with up or down spins) and compare the simulation with the case of initial random state.
- Instead of running for a fixed, given number of Monte Carlo steps, try other convergence criteria.
- Try to implement a "loop" in the ising.py program. Now it starts at a high T and explores the model decreasing T until the lower T is attained and stops. Ask the program to continue again now increasing T and check whether the system follows the same evolution in the physical magnitudes (U, m, ...) or there is hysteresis.

**Option 2:**

Change the model! Several possible options:

- Make it 1D instead of 2D. Does it has the same physical behaviour?
- Try to make it antiferromagnetic or ferrimagnetic
- Make it ideal. Suppress the spin-spin interaction but consider an external field in the -1 direction, so each atom of the system has two states of different energy, the ground state -1 (with say 0 energy) and the state +1 (with larger energy, say  $+\epsilon$ ).

**Option 3: invent yourself!**

- Please make a brief pdf report, explaining your choice and your results and also post your .py program (preferably at GitHub but it can be at the Virtual Campus).