## **Chapter 5.6: Lattice gas model**

General energy with two-body interaction  $\boldsymbol{U}$ 

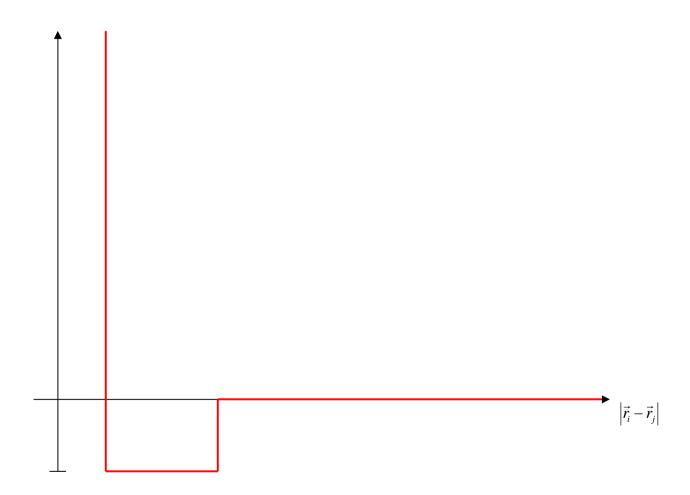
$$E = \sum_{j=1}^{N} \frac{\vec{p}_{j}^{2}}{2m} + \sum_{j=1}^{N} \sum_{i \neq j} U(\vec{r}_{i} - \vec{r}_{j})$$

## **Partition function**

$$Z_N = \frac{1}{(2\pi\hbar)^{3N} N!} \int \left( \prod_{j=1}^{N} d^3 \vec{r}_j d^3 \vec{p}_j \right) \exp(-\beta E)$$

## 5.6-2 Lattice gas model

Discretized approximation: Hard-core with potential box:



## 5.6-3 Lattice gas model

Phase transition as function of chemical potential

$$H_{\rm int} = -U \sum_{\langle l,m \rangle} n_l n_m - \mu \sum_l n_l$$

5.6-4 Lattice gas model

Monte Carlo methods and Metropolis algorithm