

Chapter 5.6: Lattice gas model

General energy with two-body interaction 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

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

5.6-4 Lattice gas model

Monte Carlo methods and Metropolis algorithm