Homework for August 1

Consider exactly the same two-fermion system as in the previous problem. Use the same initial state where both particles are at zero momentum and compute everything once again using auxiliary fields,

$$Z(L_t) = \prod_{\vec{n},n_t} \left[\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{+\infty} ds(n_x,n_t) e^{-\frac{1}{2}s^2(n_x,n_t)} \right] Z(s,L_t)$$

$$Z(s,L_t) = \langle \psi_{\text{init}} | \; \overbrace{\qquad\qquad}^{M(s,L_t-1)M(s,L_t-2) \quad \cdots \quad M(s,1)M(s,0)} \; | \psi_{\text{init}} \rangle$$

Again take the size of the periodic box to be $L = 6$ and the number of time steps to be $L_t = 50$. Use the Metropolis algorithm to calculate the energy using the estimate

$$e^{-E(L_t)\alpha_t} = Z(L_t)/Z(L_t - 1)$$

for the parameter values

$$C = -0.200,\ m = 938.92\ \text{MeV},\ a = a_t = (100\ \text{MeV})^{-1}$$