partition function in a theory of interacting bosons fields $\phi$ and fermion fields $\psi$ from

euclidian action: $x = (\vec{x}, \tau)$

$$S^E(\phi, \psi\bar{\psi}) = \int_0^{T^{-1}} d\tau \int_V d^3x \mathcal{L}^E(x)$$

($\mathcal{L}^E$ imaginary-time Lagrange density; boson (fermion) fields obey periodic (antiperiodic) boundary conditions)

partion function:

$$\mathcal{Z} = \int \mathcal{D}\phi \mathcal{D}\psi \mathcal{D}\bar{\psi} e^{-S^E(\phi, \psi\bar{\psi})}$$

thermal expectation value of a given operator $\hat{O}$

$$\begin{aligned} \langle\langle \hat{O} \rangle\rangle &= \frac{1}{\mathcal{Z}} \mathrm{Tr}\{e^{-(\hat{H}/T}\hat{O}\} \\ &= \frac{1}{\mathcal{Z}} \int \mathcal{D}\phi \mathcal{D}\psi \mathcal{D}\bar{\psi} O(\phi, \psi, \bar{\psi}) e^{-S^E(\phi, \psi, \bar{\psi})} \end{aligned}$$

field theory a statistical mechanics problem !
solvable on computers