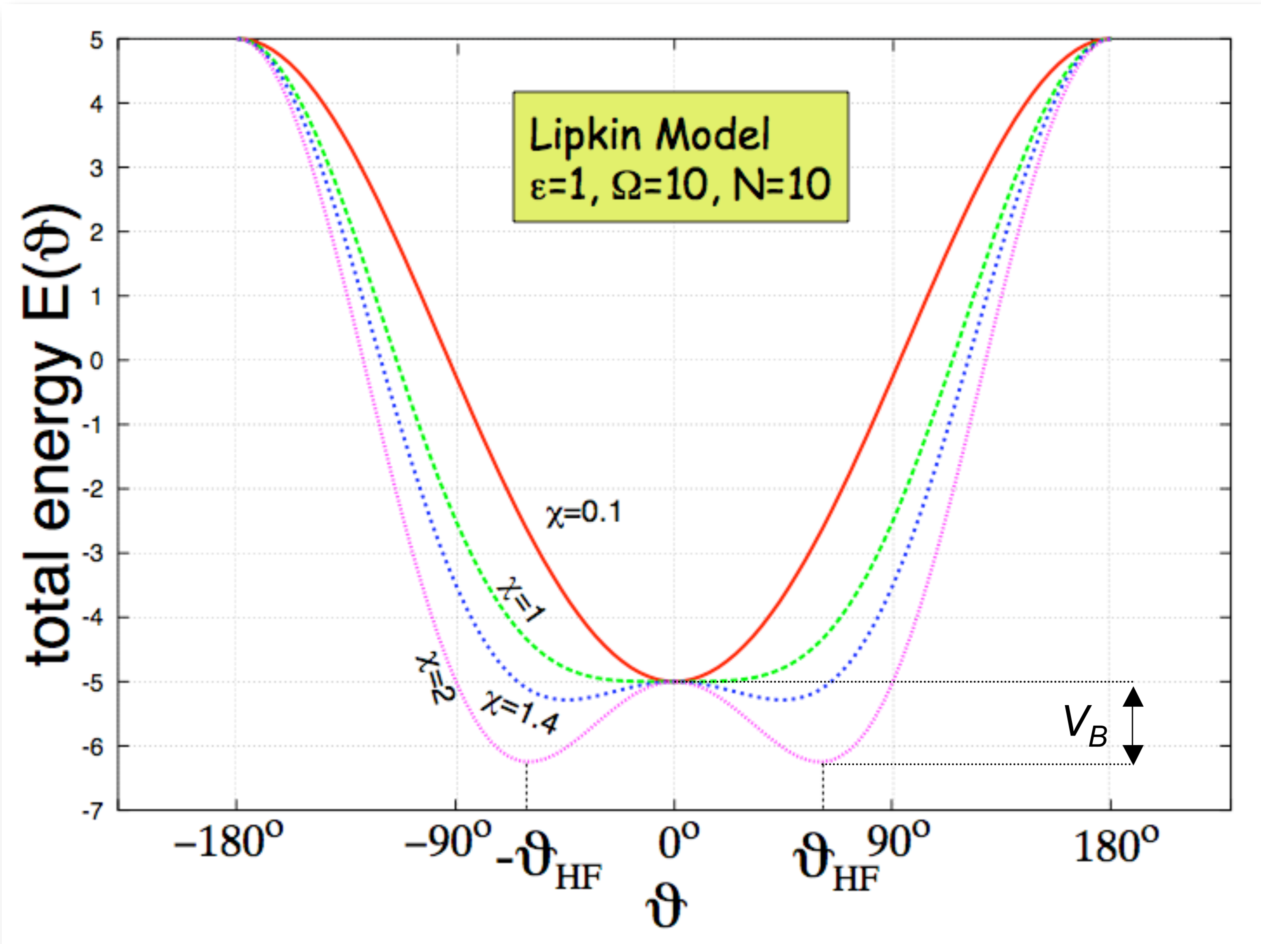

$$E_{HF} = \begin{cases} -\frac{\varepsilon}{2}\Omega & \text{for} \quad \chi < 1 \\ -\frac{\varepsilon}{4}\Omega\left(\chi + \frac{1}{\chi}\right) & \text{for} \quad \chi \geq 1 \end{cases}$$

Barrier height: $$V_B = \frac{\varepsilon}{4}\Omega\left(\chi + \frac{1}{\chi} - 2\right)$$

Deformation parameter

$$\hat{Q} \equiv \hat{K}_x = \frac{1}{2}\left(\hat{K}_+ + \hat{K}_-\right)$$

$$q \equiv \langle \tau | \hat{Q} | \tau \rangle = \frac{1}{2}\Omega \sin\theta \cos\phi$$

Deformation parameter of the Lipkin Model

$$q_{HF} = \begin{cases} 0 & \text{for} \quad \chi < 1 \\ \frac{\Omega}{2}\sqrt{1 - \frac{1}{\chi^2}} & \text{for} \quad \chi \geq 1 \end{cases}$$

For $q=0$ one is dealing with the "spherical" system
For $q>0$ one is dealing with the "deformed" system

For the exact solution, $q=0$ (why?)

Homework: calculate $\sqrt{\langle \hat{Q}^2 \rangle}$ in the LM ground state. Compare with the HF deformation.

Signature of the Hartree-Fock State

$$\hat{R} = e^{i\pi \hat{K}_o}$$

$$\begin{aligned}
\langle \tau | \hat{R} | \tau \rangle &= \frac{1}{(1+|\tau|^2)^\Omega} \left(e^{-\frac{i\pi}{2}} + e^{\frac{i\pi}{2}} |\tau|^2 \right)^\Omega \\
&= i^\Omega \left(\frac{|\tau|^2 - 1}{|\tau|^2 + 1} \right)^\Omega \\
&= (-i)^\Omega \cos^\Omega \theta \\
&= (-i)^\Omega \frac{1}{\chi^\Omega} = e^{-i\pi \frac{\Omega}{2}} \frac{1}{\chi^\Omega}
\end{aligned}$$

Ground-state signature

- Signature is broken in the deformed HF solution
- At large value of χ signature is maximally broken!
  (a complete alignment of quasi-spin along the x-axis!)