

H is invariant under time-reversal
because $J \rightarrow -J$ and H is a quadratic
function of J .

Eigenstates are.

$$\lambda = 0 \quad |0\rangle$$

$$\lambda = A+B \quad \frac{1}{\sqrt{2}} (|+\rangle + |-\rangle)$$

$$\lambda = A-B \quad \frac{1}{\sqrt{2}} (|+\rangle - |-\rangle)$$

All states are invariant under time reversal
transformation. (Apart from a phase factor).