
Exercises for
Advanced Quantum Theory

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Exercise 1

Write down the flow equation with the generator from the script, eq. (2.59) and solve them for the 2×2 real symmetric matrix

$$H = \begin{pmatrix} \epsilon_1 & v \\ v & \epsilon_2 \end{pmatrix}$$

Exercise 2

For a matrix $H = (h_{nm})$ the generator in (2.59) in the script has the form $\eta_{nm} = (h_{nn} - h_{mm})h_{nm}$. There are other possibilities for the choice of η . One possibility is

$$\eta_{nm} = \text{sign}(n - m)h_{nm}$$

1. Show that for this choice of η the matrix will be diagonal for $\ell \rightarrow \infty$ and that the diagonal elements are ordered.
2. Show that if the initial matrix is tri-diagonal, this structure is conserved for all ℓ . Remark: For those who are interested, the flow equations for this choice are equivalent to the equations of motion of the Toda lattice, a classical lattice model for solitons.