

Expansion in Pauli matrices

Philippe W. Courteille, 27/12/2021

Solution: *We have,*

$$\begin{aligned}\langle \hat{\sigma}^- \hat{\sigma}^+ \rangle &= \text{Tr} \hat{\rho} \hat{\sigma}^- \hat{\sigma}^+ = \sum_k \langle k | \begin{pmatrix} \rho_{11} & \rho_{12} \\ \rho_{11} & \rho_{12} \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} | k \rangle \\ &= \sum_k \langle k | (\rho_{11} |1\rangle\langle 1| + \rho_{12} |1\rangle\langle 2|) | k \rangle = \rho_{11} .\end{aligned}$$