9.2: Physical Observables

Physical observables are represented by linear, hermitian operators that act on the vectors of the Hilbert space. If A is such an operator, and $|\phi\rangle$ is an arbitrary vector in the Hilbert space, then A might act on $|\phi\rangle$ to produce a vector $|\phi'\rangle$, which we express as

$$A|\phi\rangle = |\phi'\rangle$$

Since $|\phi\rangle$ is representable as a column vector, A is representable as a matrix with components

$$A = \begin{pmatrix} A_{11} & A_{12} & A_{13} & \cdots \\ A_{21} & A_{22} & A_{23} & \cdots \\ . & . & . & \cdots \end{pmatrix}$$

The condition that A must be hermitian means that

$$A^\dagger = A$$

or

$$A_{ij} = A_{ji}^*$$

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