

The transition from discrete to continuous spaces

Use	Object	Symbolic: Dirac	Discrete: \mathbb{C}^n	Continuous: L^2
Quantum State	Ket	$ \psi\rangle$	$\begin{pmatrix} \psi_1 \\ \psi_2 \end{pmatrix}$	$\psi(x)$
Projection	Inner Product	$\langle\phi \psi\rangle$	$(\phi_1^* \ \phi_2^*) \begin{pmatrix} \psi_1 \\ \psi_2 \end{pmatrix}$	$\int \phi^*(x)\psi(x) dx$
Normalization	Inner Product	$\langle\psi \psi\rangle = 1$	$(\psi_1^* \ \psi_2^*) \begin{pmatrix} \psi_1 \\ \psi_2 \end{pmatrix} = 1$	$\int \psi^*(x)\psi(x) dx = 1$
Orthogonality	Inner Product	$\langle\phi \psi\rangle = 0$	$(\phi_1^* \ \phi_2^*) \begin{pmatrix} \psi_1 \\ \psi_2 \end{pmatrix} = 0$	$\int \phi^*(x)\psi(x) dx = 0$
Change of basis	Sum of Projections	$\sum_n \langle\phi_n \psi\rangle \phi_n\rangle$	$\begin{pmatrix} \phi_{11}^* & \phi_{12}^* \\ \phi_{21}^* & \phi_{22}^* \end{pmatrix} \begin{pmatrix} \psi_1 \\ \psi_2 \end{pmatrix}$	$\sum_n \left(\int \phi_n^*(x)\psi(x) dx \right) \phi_n(x)$
Probability	Sum of Moduli Squared		$\sum_{n=a}^b \psi_n ^2$	$\int_a^b \psi(x) ^2 dx$