The transition from discrete to continuous spaces

Use	**Object**	**Symbolic: Dirac**	**Discrete: $\mathbb{C}^n$**	**Continuous: L^2**
Quantum State	Ket	$\mid\psi\rangle$	$\begin{pmatrix}\psi_1\\ \psi_2\end{pmatrix}$	$\psi(x)$
Projection	Inner Product	$\langle\phi\vert\psi\rangle$	$\begin{pmatrix}\phi_1^* & \phi_2^*\end{pmatrix}\begin{pmatrix}\psi_1\\ \psi_2\end{pmatrix}$	$\int \phi^*(x)\psi(x)\,dx$
Normalization	Inner Product	$\langle\psi\vert\psi\rangle = 1$	$\begin{pmatrix}\psi_1^* & \psi_2^*\end{pmatrix}\begin{pmatrix}\psi_1\\ \psi_2\end{pmatrix} = 1$	$\int \psi^*(x)\psi(x)\,dx = 1$
Orthogonality	Inner Product	$\langle\phi\vert\psi\rangle = 0$	$\begin{pmatrix}\phi_1^* & \phi_2^*\end{pmatrix}\begin{pmatrix}\psi_1\\ \psi_2\end{pmatrix} = 0$	$\int \phi^*(x)\psi(x)\,dx = 0$
Change of basis	Sum of Projections	$\sum_n \langle\phi_n\vert\psi\rangle \mid\phi_n\rangle$	$\sum_n \left[\begin{pmatrix}\phi_{n_1}^* & \phi_{n_2}^*\end{pmatrix}\begin{pmatrix}\psi_1\\ \psi_2\end{pmatrix}\right]\begin{pmatrix}\phi_1\\ \phi_2\end{pmatrix}$	$\sum_n \left[\int \phi_n^*(x)\psi(x)\,dx\right]\phi_n(x)$
Probability	Sum of Moduli Squared		$\sum_{n=a}^{b} \vert\psi_n\vert^2$	$\int_a^b \vert\psi(x)\vert^2\,dx$