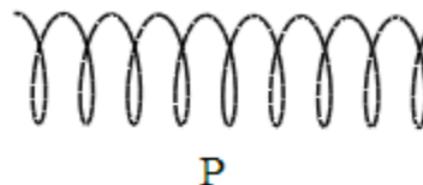
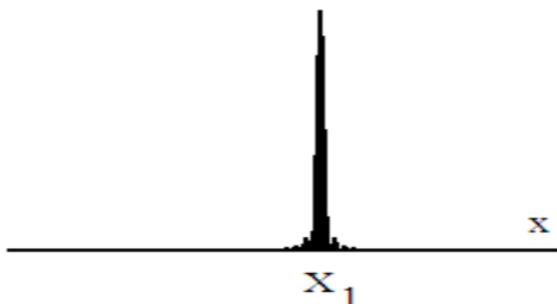


1.22: Relationship Between the Coordinate and Momentum Representations

A quon has position $x_1 : |x_1\rangle$

Coordinate space \Leftrightarrow Fourier Transform \Leftrightarrow Momentum space

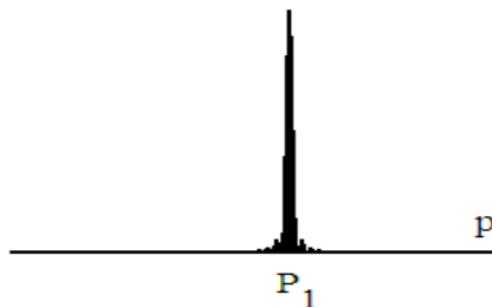
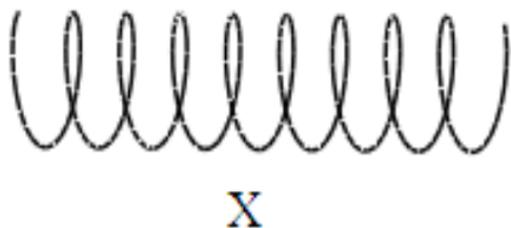
$$\langle x|x_1\rangle = \delta(x - x_1) = \frac{\int \langle p|x\rangle \langle x|x_1\rangle dx}{\int \langle x|p\rangle \langle p|x_1\rangle dp} \Leftrightarrow \langle p|x_1\rangle = \exp\left(-\frac{ipx_1}{\hbar}\right)$$



A quon has momentum $p_1 : |p_1\rangle$

Coordinate space \Leftrightarrow Fourier Transform \Leftrightarrow Momentum space

$$\langle x|p_1\rangle = \exp\left(\frac{ip_1x}{\hbar}\right) = \frac{\int \langle p|x\rangle \langle x|p_1\rangle dx}{\int \langle x|p\rangle \langle p|p_1\rangle dp} \Leftrightarrow \langle p|p_1\rangle = \delta(p - p_1)$$



Please note the important role that the coordinate and momentum completeness relations play in these transformations.

$$\int |x\rangle \langle x| dx = 1 \quad \text{and} \quad \int |p\rangle \langle p| dp = 1$$

This page titled [1.22: Relationship Between the Coordinate and Momentum Representations](#) is shared under a [CC BY 4.0](#) license and was authored, remixed, and/or curated by [Frank Rioux](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.