A photon is in a state:

$$\frac{1}{\sqrt{2}}|x_1\rangle + \frac{1}{\sqrt{2}}|x_2\rangle,$$

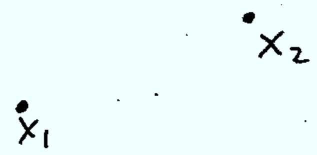
a quantum superposition of two position eigenstates. This state describes:

A) one photon at x_1 and another at x_2.

B) a single photon at a position somewhere in between x_1 and x_2.

C) a single photon at a specific location, but we don't know the location since we haven't measured it yet.

D) a single photon that does not have a definite location.



An electron is in a state

$$\frac{1}{2}|x_1\rangle - \frac{\sqrt{3}}{2}|x_2\rangle$$

If we measure the electron's position, the result that we are most likely to find is

A) x_1

B) x_2

C) $\frac{1}{2}x_1 - \frac{\sqrt{3}}{2}x_2$

D) $\frac{1}{4}x_1 + \frac{3}{4}x_2$

E) None of the above

• x_2

• x_1

An electron is in a state

$$\frac{1}{2}|x_1\rangle - \frac{\sqrt{3}}{2}|x_2\rangle$$

If we measure the electron's position, the result that we are most likely to find is

A) x_1 ⟶ Prob. $\frac{1}{4} = \left|\frac{1}{2}\right|^2$

(B) x_2 ⟶ Prob. $\frac{3}{4} = \left|-\frac{\sqrt{3}}{2}\right|^2$

C) $\frac{1}{2}x_1 - \frac{\sqrt{3}}{2}x_2$

D) $\frac{1}{4}x_1 + \frac{3}{4}x_2$ ⟶ this is the average value if we did the experiment a large # of times.

E) None of the above

Immediately repeated measurements of an electron's position give the same result. This implies that

A) The electron's wavefunction generally stays the same when we do a measurement.

B) The electron's wavefunction generally changes when we do a measurement.

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A) The electron's wavefunction generally stays the same when we do a measurement.

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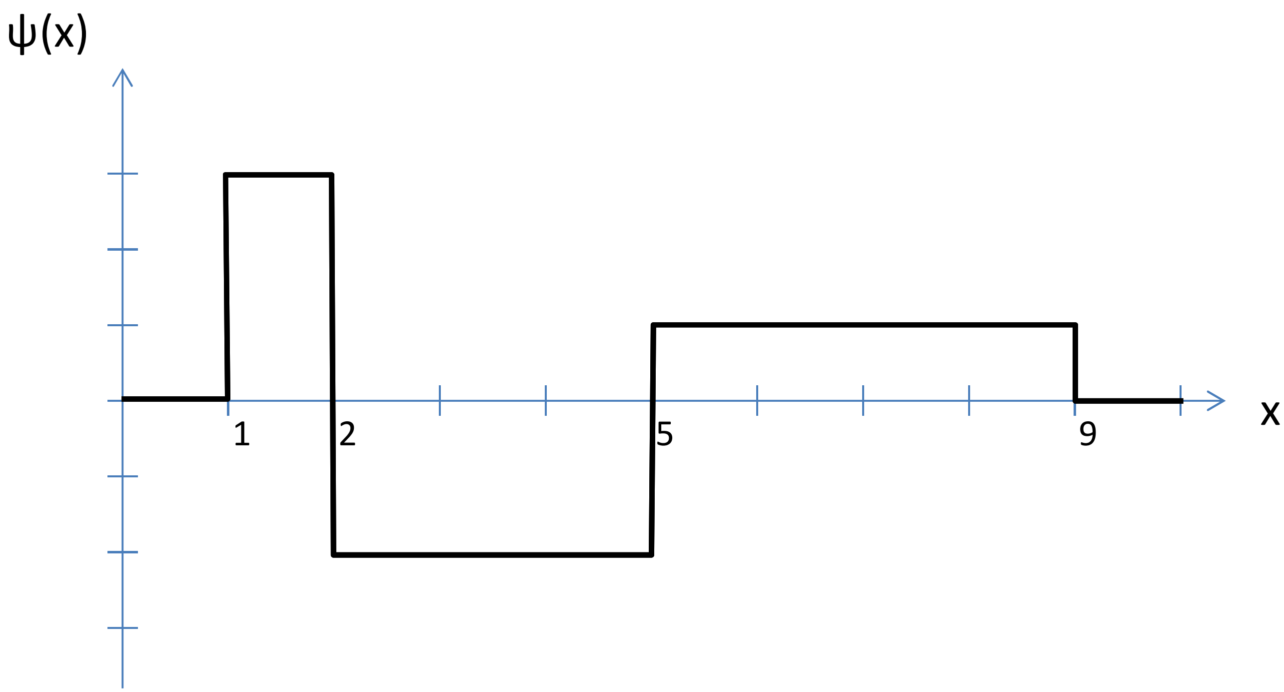
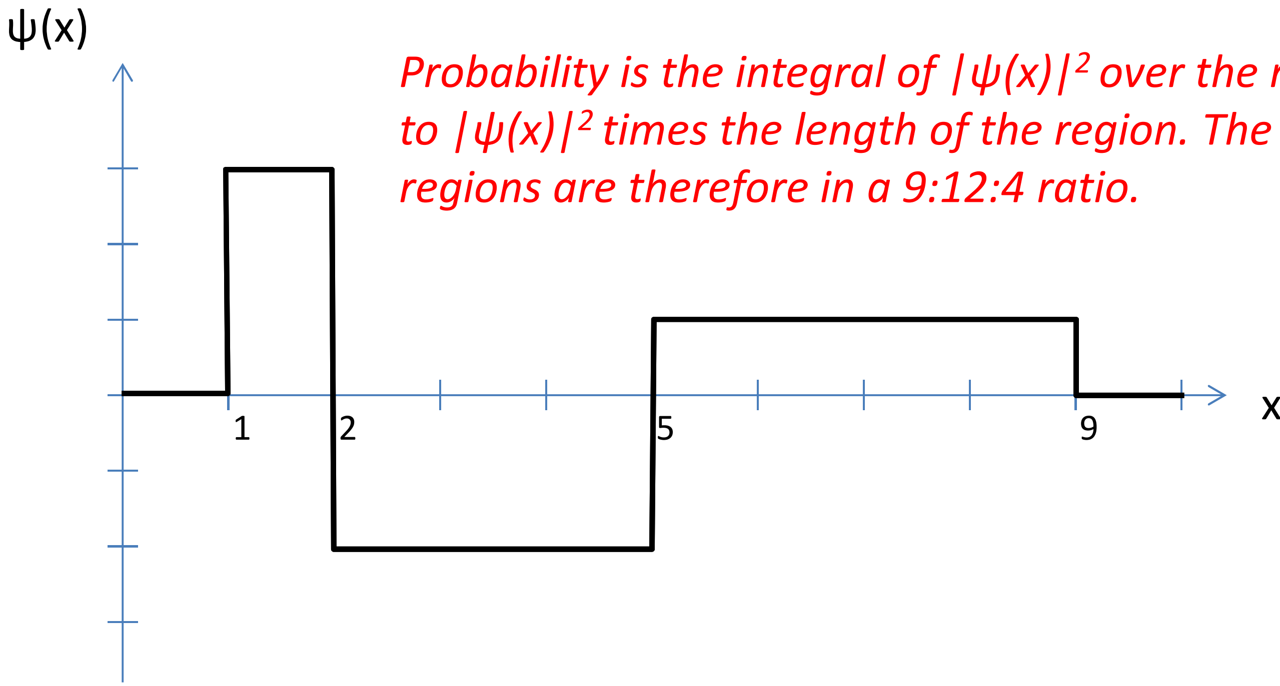
Original wavefunction → superposition of position eigenstates,
→ position not predetermined

After measurement: know position
→ state = position eigenstate
∴ wavefunction has changed



The wavefunction for an electron in a one-dimensional wire is shown. If we measure the position, the electron is most likely to be found:

A) Between 1 and 2
B) Between 2 and 5
C) Between 5 and 9
D) All are equally likely
E) The answer cannot be determined from the information given



Probability is the integral of $|\psi(x)|^2$ over the region, so is proportional to $|\psi(x)|^2$ times the length of the region. The probabilities for the three regions are therefore in a 9:12:4 ratio.

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