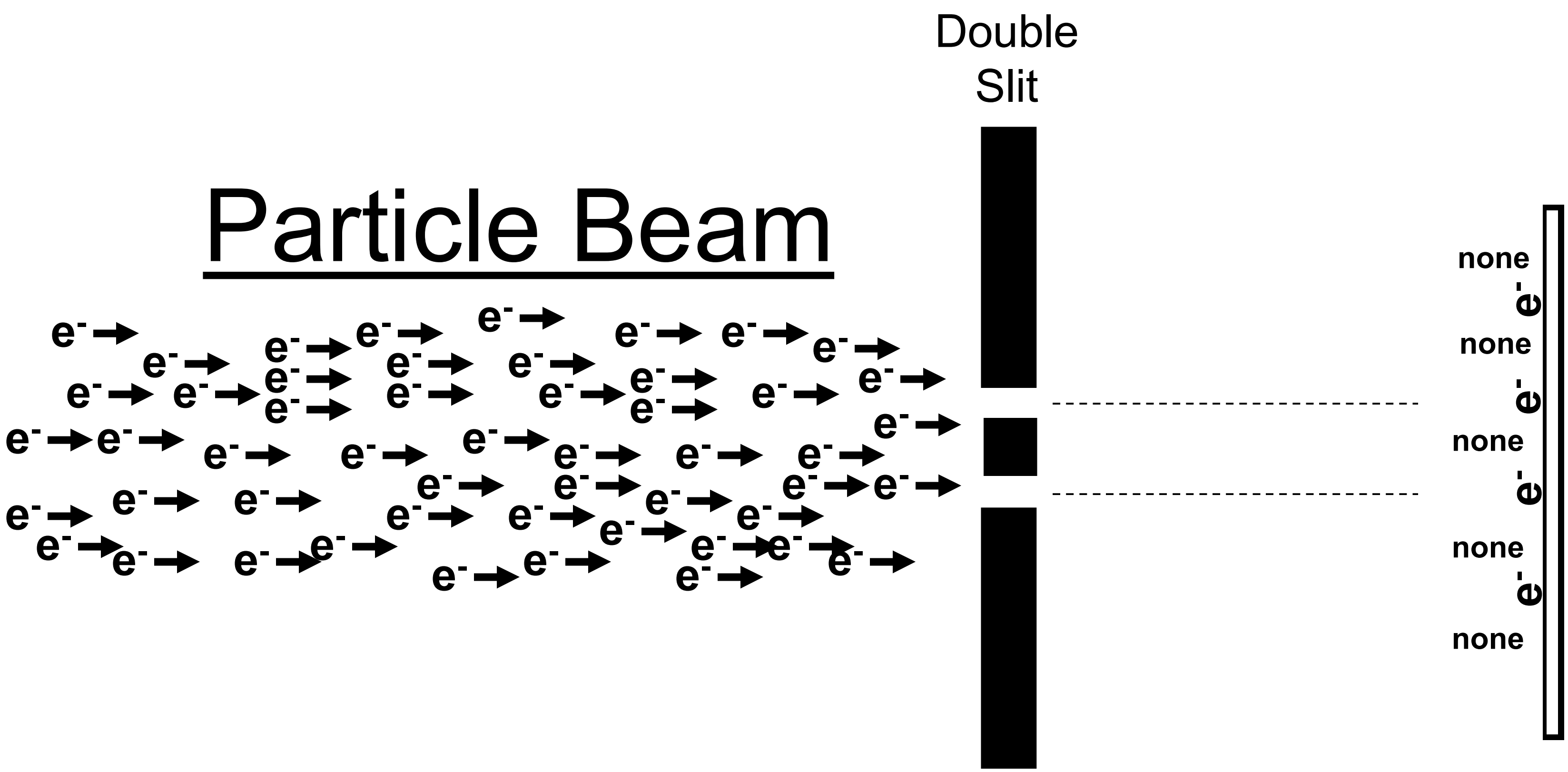
Particles and Waves... Continued.



Conclusion: Electrons are behaving as waves!

Wavelengths of Particles:

$$\lambda_{particle} = \frac{h}{m \times u}$$

Particle's Mass *(kg)*

Particle's velocity *(m/s)*

e^-

$$\lambda_{car} = \frac{h}{m_{car} \times u_{car}}$$

$$\lambda_{car} = \frac{6.626 \times 10^{-34}\ \text{Js}}{(1360\ \text{kg}) \times (24.58\ \text{m/s})}$$

$$\lambda_{car} = 1.982 \times 10^{-38}\ \text{m}$$ *(very small)*

$$\lambda_{e-} = \frac{h}{m_{e-} \times u_{e-}}$$

$$\lambda_{e-} = \frac{6.626 \times 10^{-34}\ \text{Js}}{(9.1\times10^{-25}\ \text{kg}) \times (24.58\ \text{m/s})}$$

$$\lambda_{e-} = 2.96 \times 10^{-11}\ \text{m}\ \ (0.296\ \text{Å})$$

When Particle Wavelength is Important.

When the wavelength of the particle is of the same approximate dimensions as the particle's surroundings...

...then the wave nature of the particle becomes important.

λ_{car} **= 1.982 × 10^{-38} m** *(very small)*

Surroundings: Bridges, other cars, roads, trees, etc. (3-50 m)

λ_{car} **<<<<< dimensions$_{surroundings}$**

∴ **Wave nature of car <u>is not important</u>**

e^-

λ_{e-} **= 2.96 × 10^{-11} m (0.296 Å)**

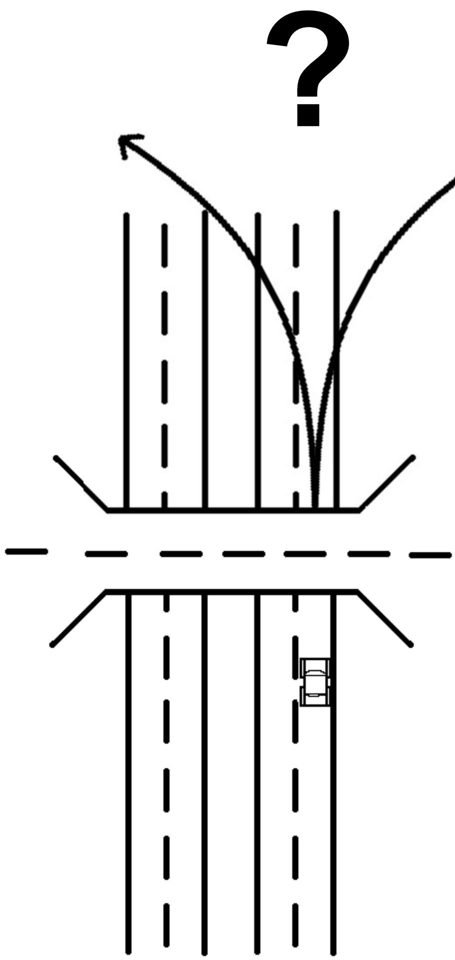
Surroundings: atoms, molecules, etc. (~10^{-10}m)

λ_{e-} ≈ **dimensions$_{surroundings}$**

∴ **Wave nature of e^- <u>is important</u>**

What if Planck's Constant ...wasn't so small?

What if....h = 50000 Js



$$\lambda_{car} = \frac{h}{m_{car} \times u_{car}}$$

$$\lambda_{car} = \frac{50000 \text{ Js}}{(1360 \text{ kg}) \times (24.58 \text{ m/s})}$$

$$\lambda_{car} = 1.49 \text{ m}$$

$$\lambda_{car} \approx \text{dimensions}_{surroundings}$$

Now Observable: Interference, diffration (path bending).