Physics 100 - February 25, 2009

- Exam 1 March 2 - in Hoyt - reg lecture time
- Allowed 3x5 in index card w/ notes
- Bring calculator ... be able to do "powers of ten"
- Q+A session Friday, Feb 27 4pm
  in Meliora 208
- No lecture in Hoyt on March 4
  I'll post PDF lecture slides and
  accompanying mp3 audio file
- No recitations Next week
  (March 2-6)

Last Time

Electrons are Waves

Quantum mechanics

$$-\frac{\hbar^2}{2m}\frac{d^2\psi(x)}{dx^2} + V\psi(x) = E\psi(x)$$

Single e^- ATOM

Spherical geometry

+

$$F = k\frac{q_1 q_2}{r^2}$$

"Coulombs law"

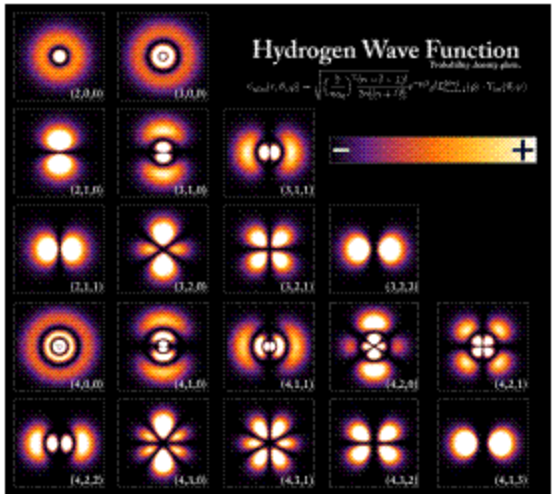
I hope this looks familiar!

Quantized spatial locations

Energies

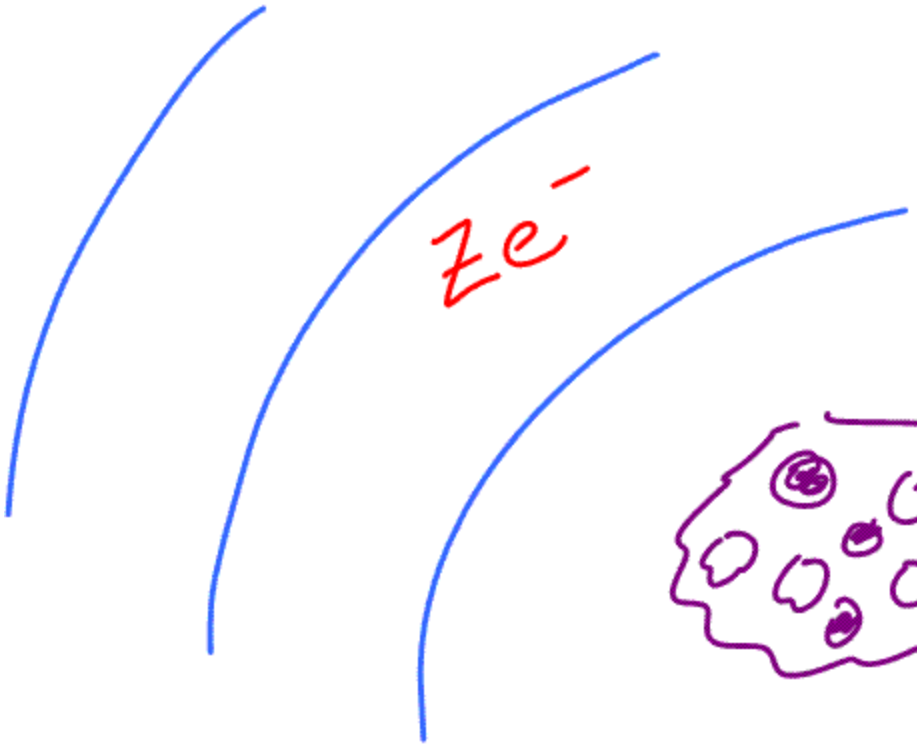
⋮

Quantized Atomic "STATES" or "orbitals"



Explains single e^- ATOM Spectra

What about ATOMS with More than 1 e^- ?



Also called the ATOMIC Number

Z protons

(A - Z) neutrons

nucleus

10^{-15} m ~ size of nucleus

$\sim 10^{-10}$ m

~ size of ATOM

A ≡ Atomic Mass

~ # protons + # neutrons

Different Z → Different # e^- in neutral ATOM

→ Different chemical characteristics + Mass

"Elements"

Slightly over 100 elements in nature

How do electrons Fill the orbitals? "Condos"

Are they Prim + Proper

or

Promiscuous + Amoral

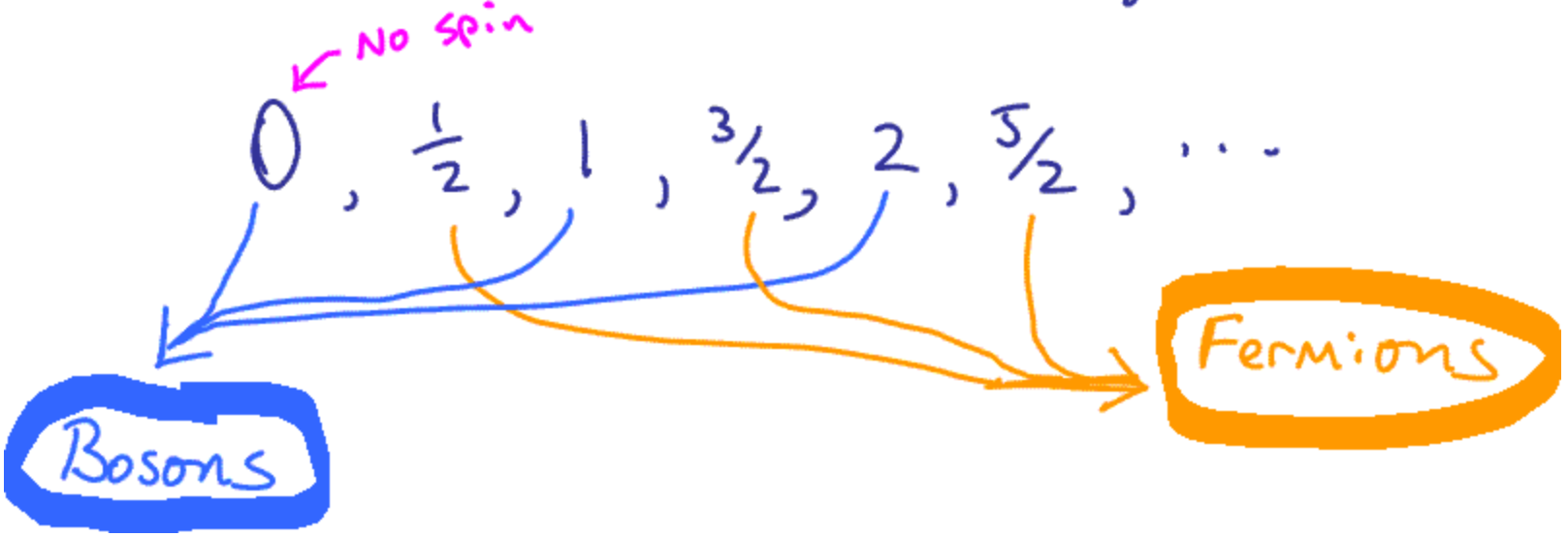
or something in between

In 1922, particles discovered to have intrinsic **Spin**

intrinsic "magnetic moments"

Think of as small bar magnets

Particle spin is Quantized

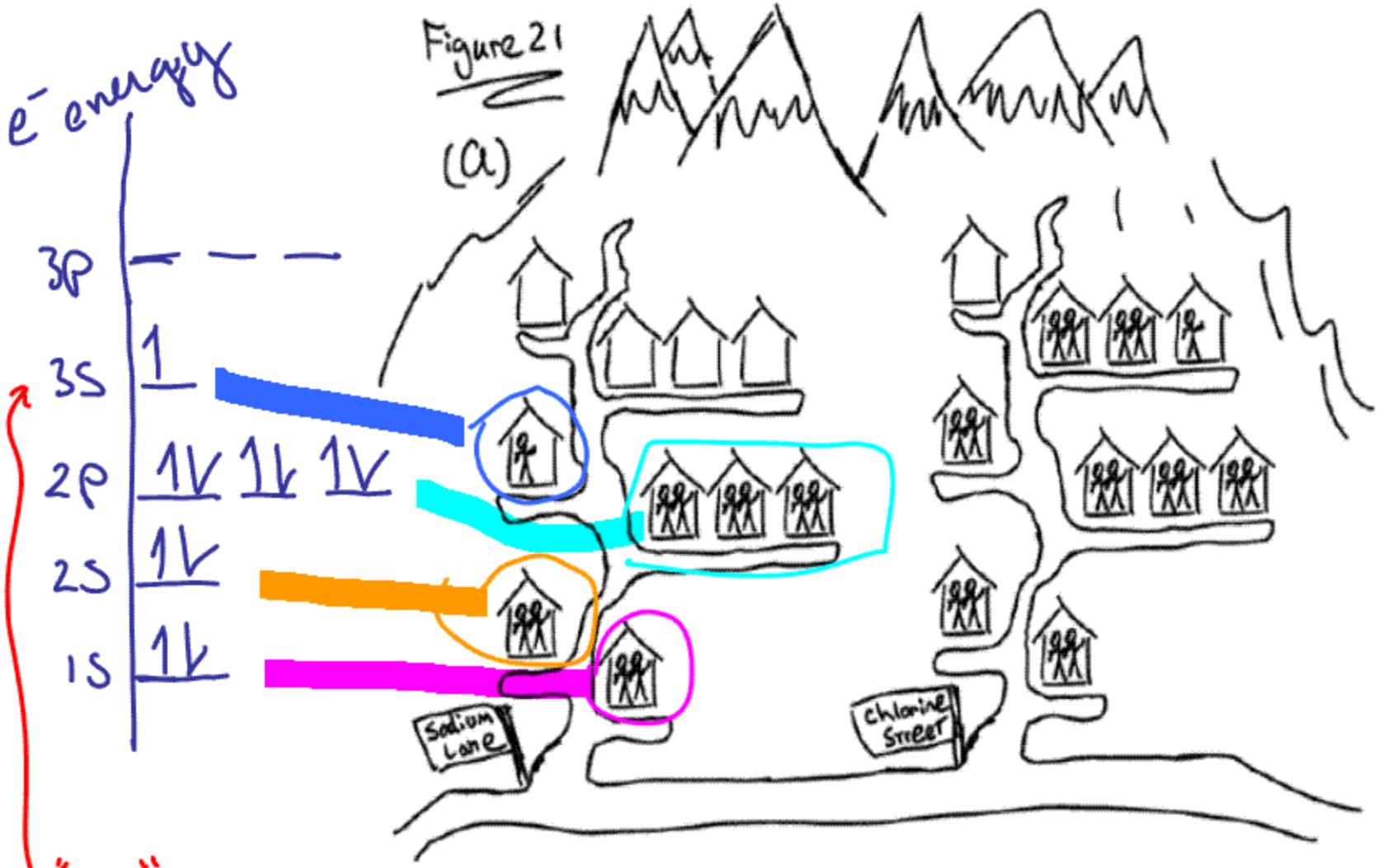


Bosons - can share the same condo or quantum STATE

fermions - only 1 to a STATE

→ in each orbital or condo can have 2 e^-
- one spin "up"
- one spin "down"

With spin included as part of quantum STATE → have only 1 e^- per STATE



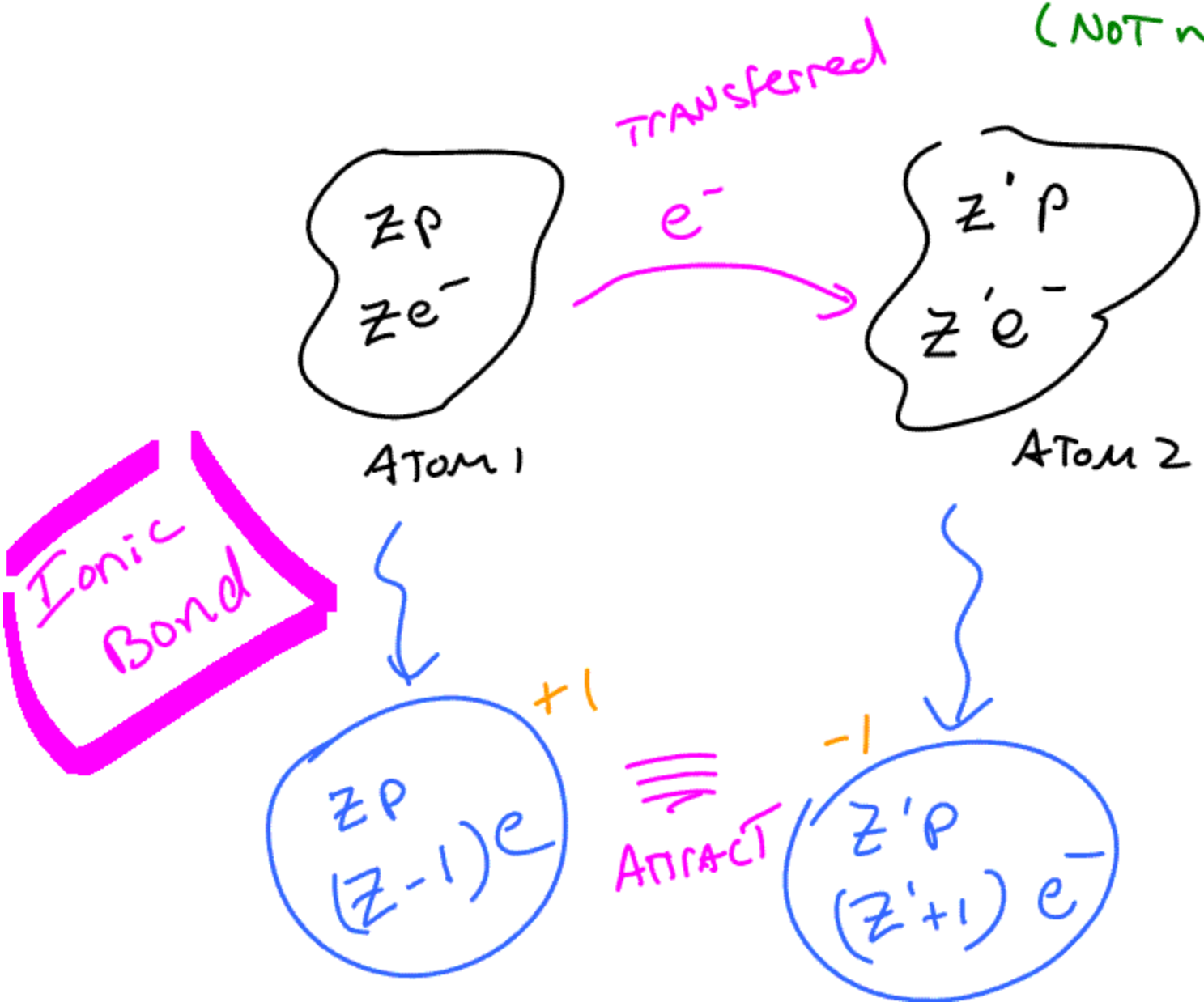
"outer" electrons

most important

in determining size + chemical characteristics of atom

Chemical Bonds

Ions ≡ Atom w/ e^- added or removed (NOT neutral)



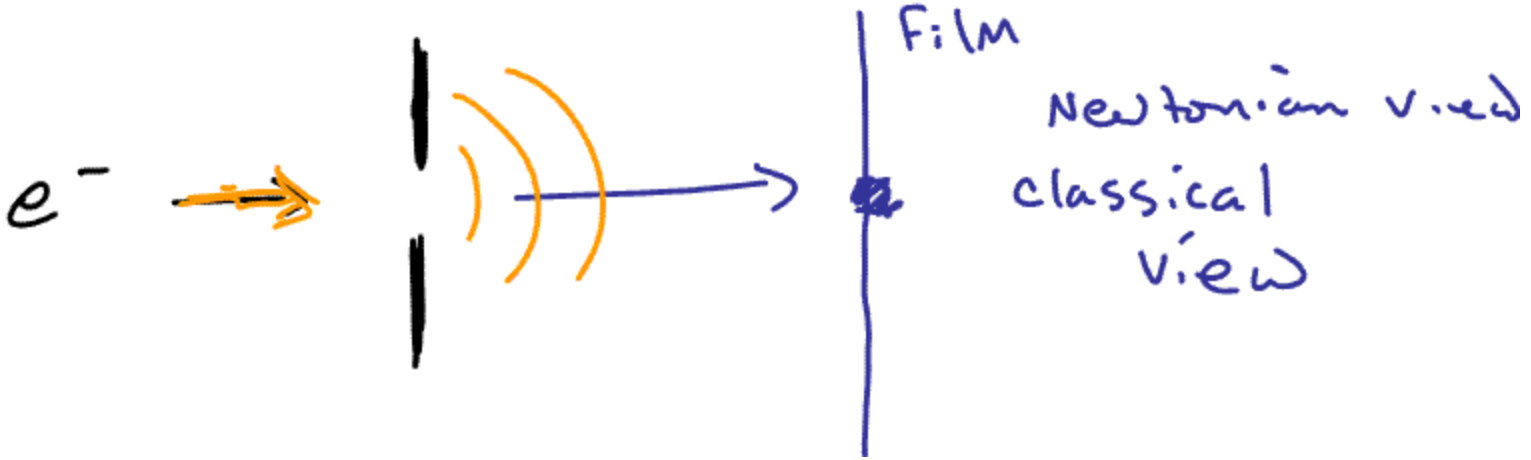
+
nucleus
e⁻
e⁻
+ nucleus
Covalent Bond
e⁻
e⁻

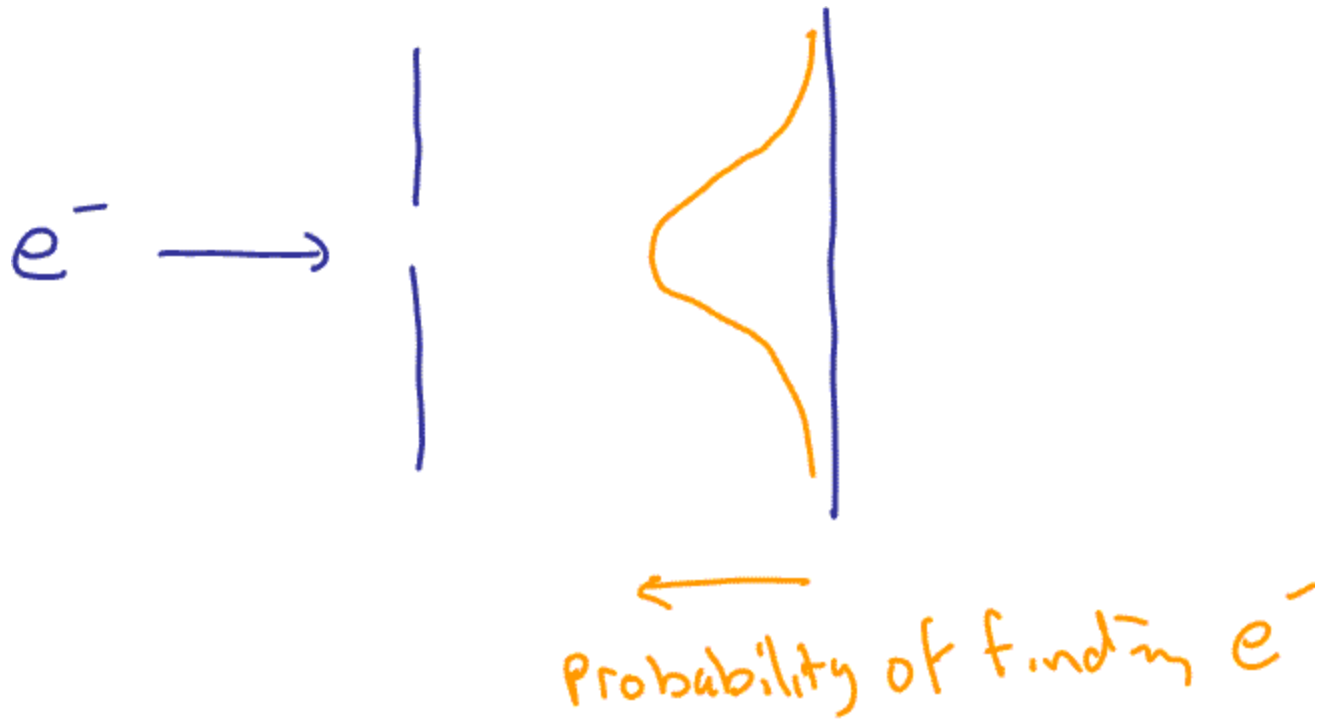
Quantum uncertainty

$$-\frac{\hbar^2}{2m}\frac{d^2\psi(x)}{dx^2} + V\psi(x) = E\psi(x)$$

$\psi(x) \equiv$ Wave function

ψ^2 corresponds to measure of probability




e⁻
Probability of finding e⁻

é

Talked a bit about quantum uncertainty
Will discuss more extensively
with decent slides for March 4 lecture