Back to the big picture in this course.

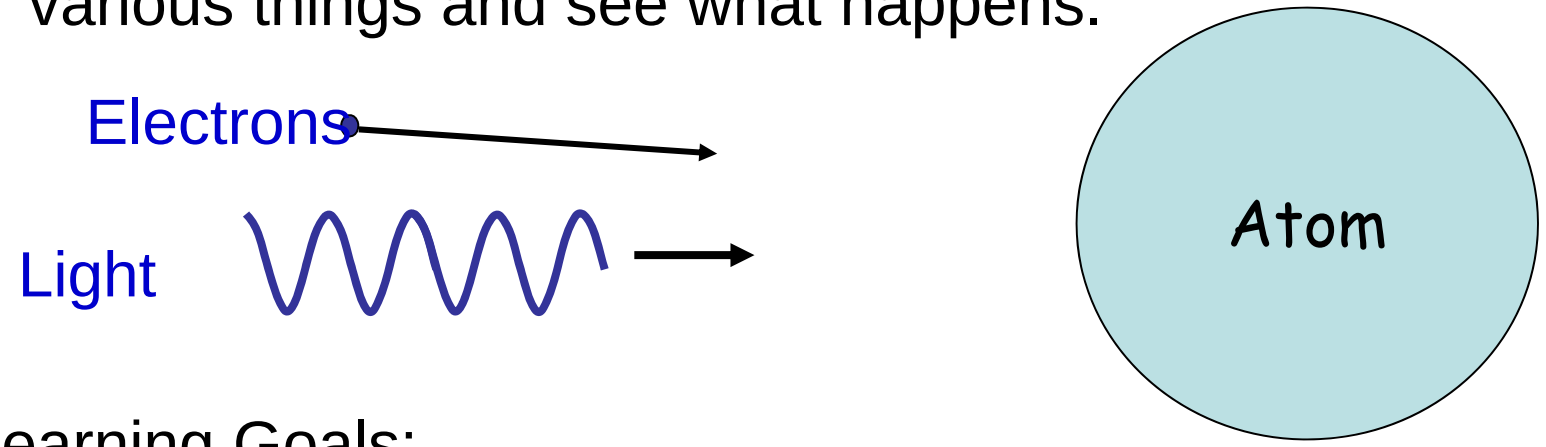
Ideas central to understanding and using Quantum Mechanics

1. Understanding that light has both particle-like and wave-like characteristics. (Photoelectric Effect, Interference Patterns) *(application- light detectors)*
2. Understanding that this implies not everything exactly determined. Behavior fundamentally governed by randomness and probability.

3. Understanding how light interacts with and is produced by *individual* atoms. What that says about atoms and behavior of electrons in atoms.
4. Understand that wave-particle duality of photons applies to electrons (and everything else), so does randomness and prob.
5. Mathematical description to calculate.
6. Apply these ideas to all kinds of interesting stuff.

Understanding how light interacts with and is produced by *individual* atoms and what that tells us about how to describe atoms and about behavior of electrons in atoms

How to look at atoms? Experiment! Hit atoms with various things and see what happens.



Learning Goals:

1. How Rutherford scattering established atom made up of small heavy nucleus with large cloud of light electrons.

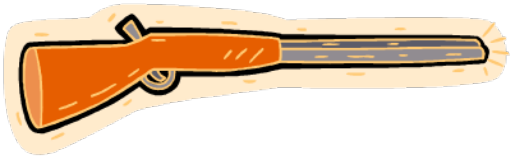
2. What one sees if bash atoms with anything, particularly electrons, as in a discharge lamp.

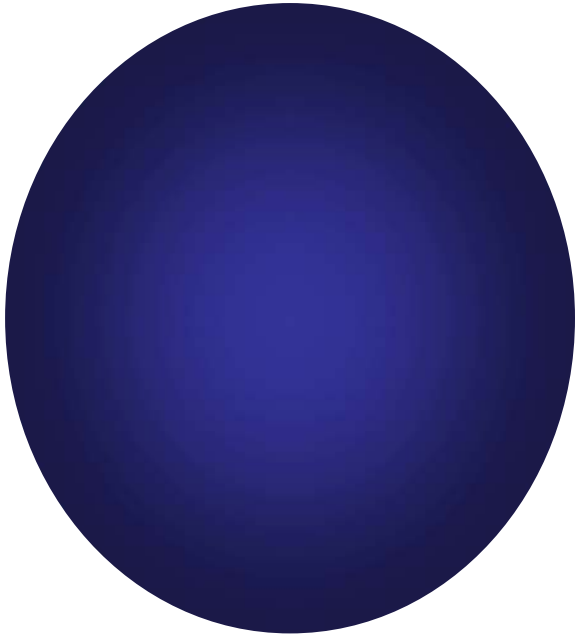
3. What light coming from atoms ("spectra") imply about behavior of electrons in atom.

Investigating Atoms: An analogy with jello ball

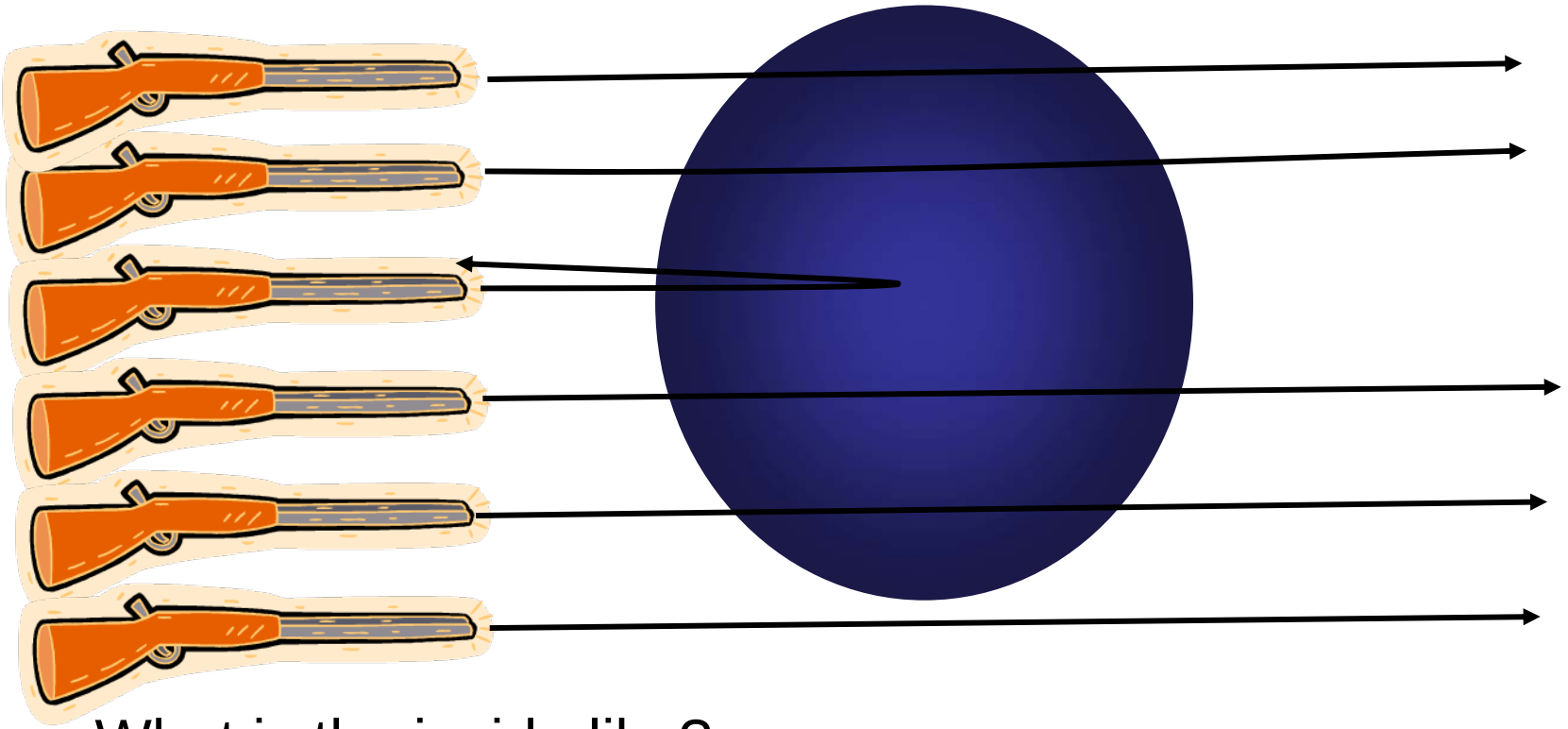
Have a heavy blob that seems like grape jello, and you have gun with rubber bullets. How to find out what the middle of the blob is like? (very similar to the famous early atomic "plum pudding" model proposed by J.J. Thompson in 1898)

Student suggestions--





Have a heavy blob that seems like grape jello, and you have gun with rubber bullets. How to find out what the middle of the blob is like? Shoot bunch of bullets into it and see this.



What is the inside like?

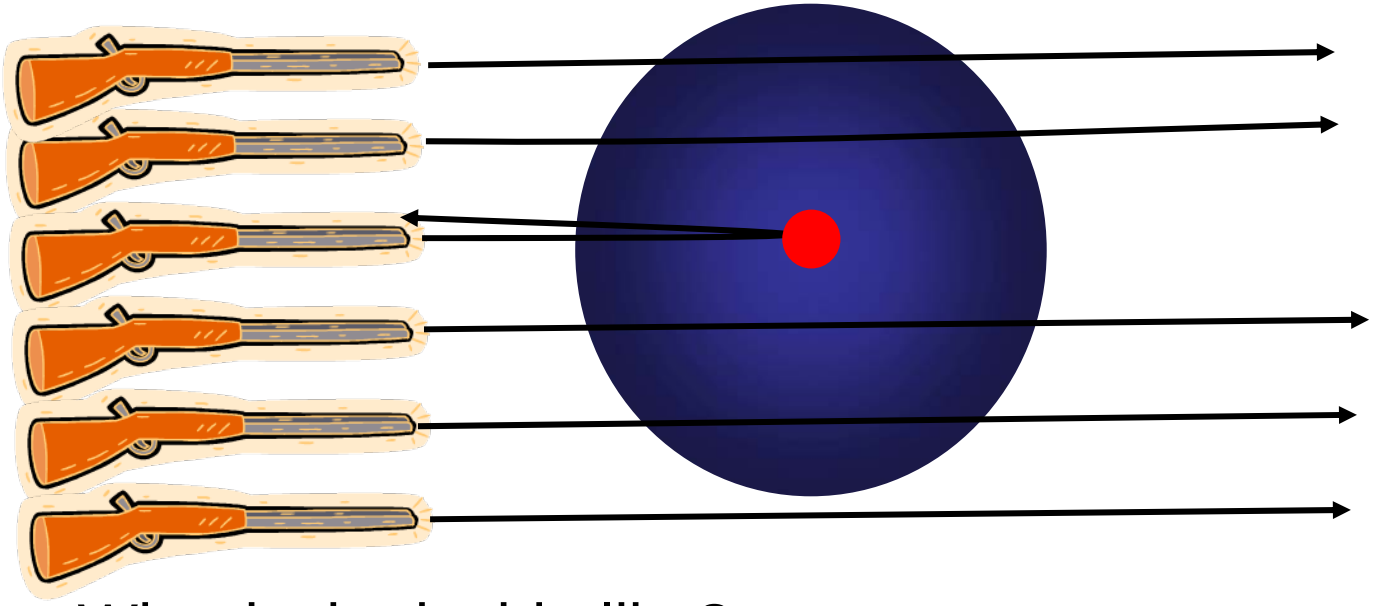
a. hollow

b. solid jello

c. hard heavy core surrounded by jello

d. bunch of hard little objects distributed through blob

Have a heavy blob that seems like grape jello, and you have gun with rubber bullets. How to find out what the middle of the blob is like? Shoot bunch of bullets into it and see this.



What is the inside like?

c. hard heavy core surrounded by jello

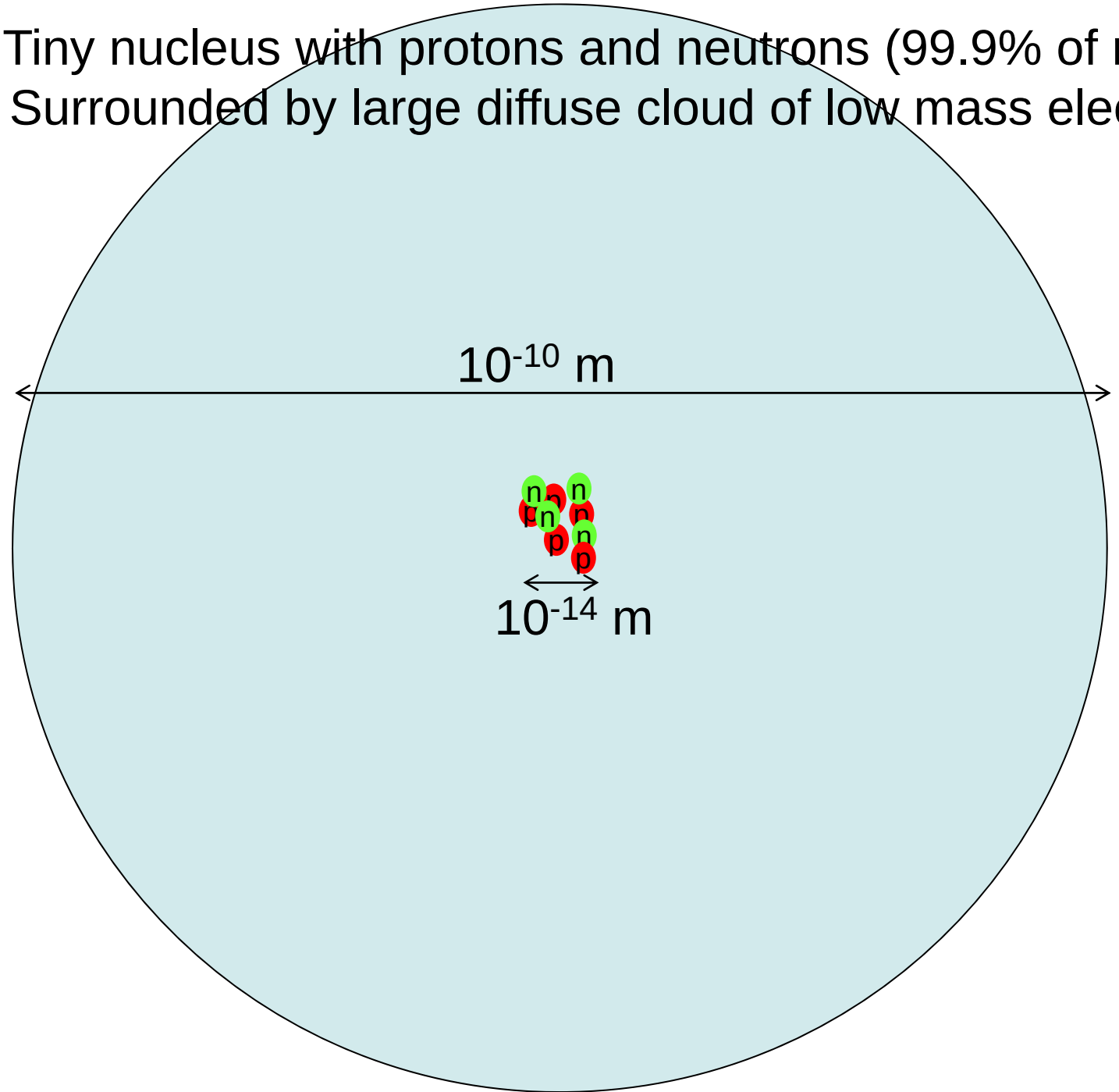
Only one thing is reflecting bullets, sending them straight back so must be hard and heavy.

Essentially Rutherford experiment and conclusion.

Rutherford shot alpha particles = 2 protons, 2 neutrons

Bullets =  Positive charge

Atom: Tiny nucleus with protons and neutrons (99.9% of mass)
Surrounded by large diffuse cloud of low mass electrons



Bash atoms with electrons and see what happens

Look at with diffraction gratings and atomic discharge lamps.
Mercury, Sodium, neon

Hold grating only by edges...oil from hands ruins grating.
Hold close to eye... See rainbow from lights.
Turn so rainbow is horizontal.

In atomic discharge lamps, lots of electrons given bunch of energy (voltage). Bash into atoms. *("Neon" lights, Mercury street lamps)*