

# The Atomic Model

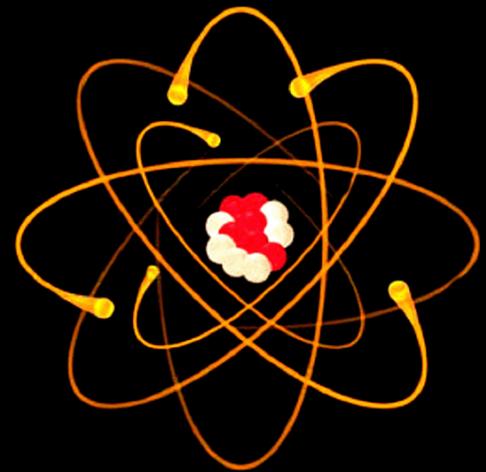
*A Timeline of Discovery*

# Atomic Theory Timeline

The atomic model has changed over time.

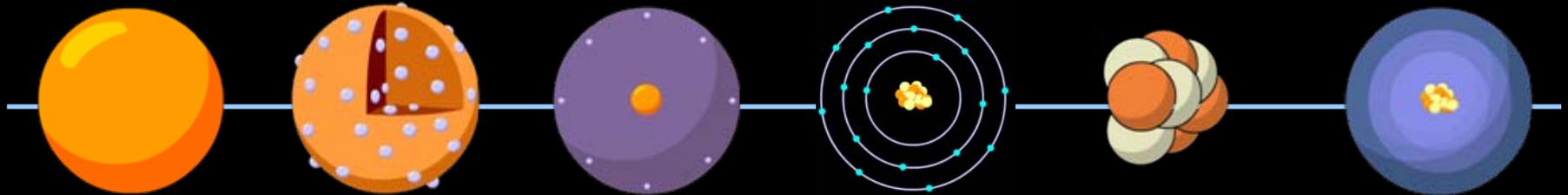
For over two centuries, scientists have created different models of the atom.

As scientists have learned more and more about atoms, the atomic model has changed.



# Atomic Theory Timeline

Here is a timeline of some of the major ideas.



Dalton



Thomson



Rutherford



Bohr



Chadwick



Modern

# But First, Democritus!

Democritus was a Greek philosopher (470–380 B.C.) who is the father of modern atomic thought.

He proposed that matter could NOT be divided into smaller pieces forever.

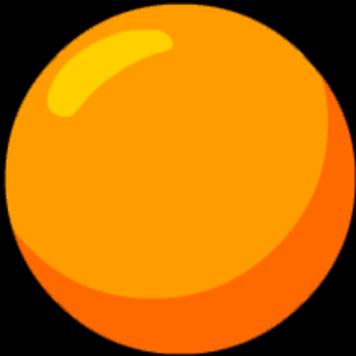
He claimed that matter was made of small, hard particles that he called “**atomos**”



# John Dalton - 1808

John Dalton created the very first atomic theory.

Dalton was an English school teacher who performed many experiments on atoms.



Dalton viewed atoms  
as tiny, solid balls.

His atomic theory  
had 4 statements...

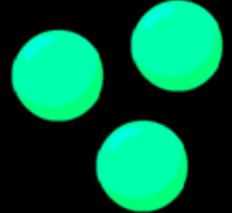


# Dalton's Theory

1. Atoms are tiny, invisible particles.



2. Atoms of one element are all the same.



3. Atoms of different elements are different.



4. Compounds form by combining atoms.



# J.J. Thomson (1897)

J.J. Thomson discovered electrons.

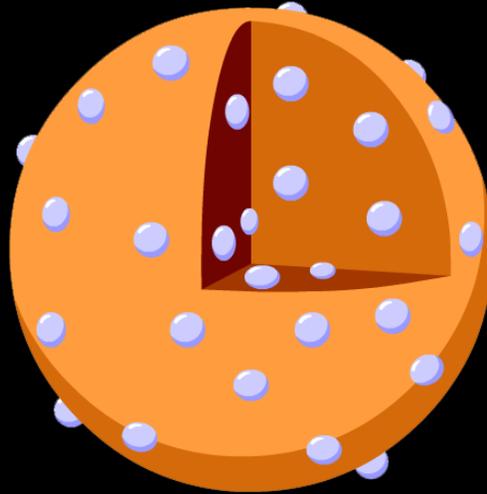
He was the first scientist to show that the atom was made of even smaller things.

He also proposed the existence of a (+) particle...

His atomic model was known as the “raisin bun model”...



# Thomson's Model



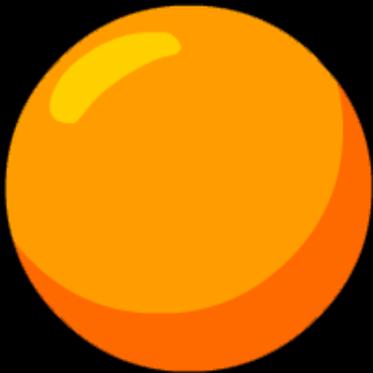
Atoms are made mostly out of (+) charged material, like dough in a bun.

The (-) charged electrons are found inside the (+) dough.

# Ernest Rutherford (1911)

Rutherford discovered protons and the nucleus.

He showed that atoms have (+) particles in the center, and are mostly empty space.



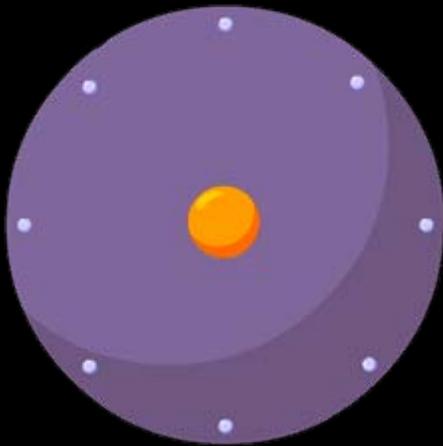
He called these (+) particles protons.



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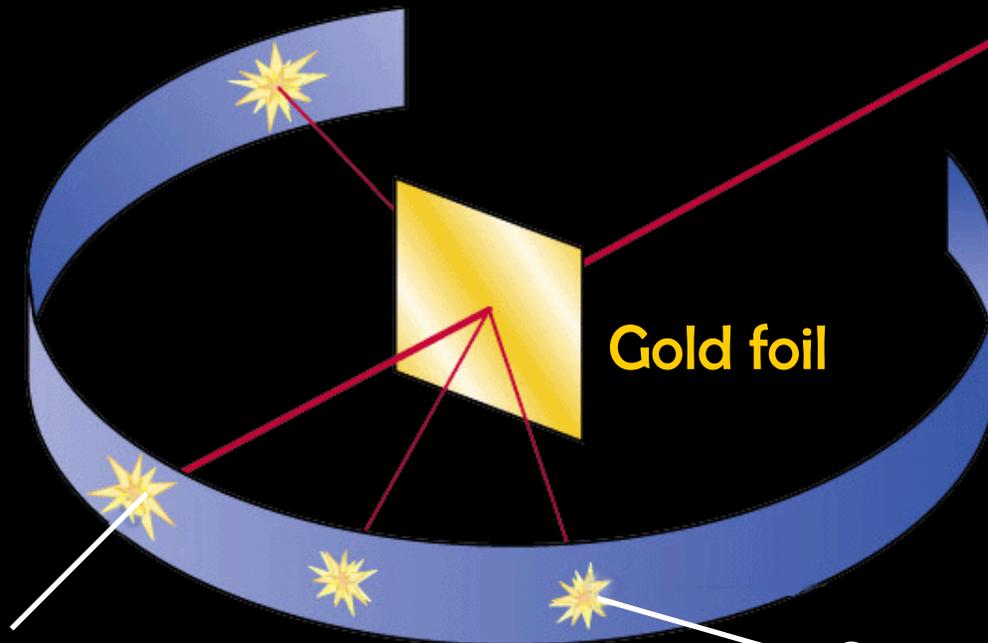
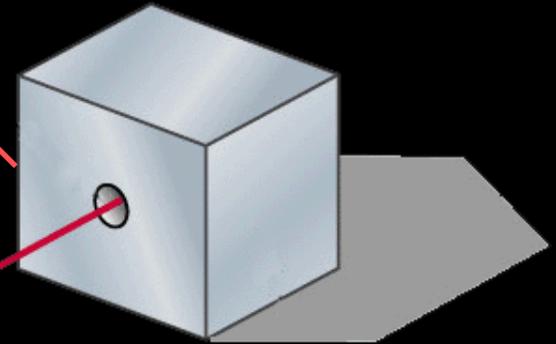


He called the center of atoms the nucleus.



# Rutherford's Experiment

Radioactive material emits  
beam of (+) alpha particles

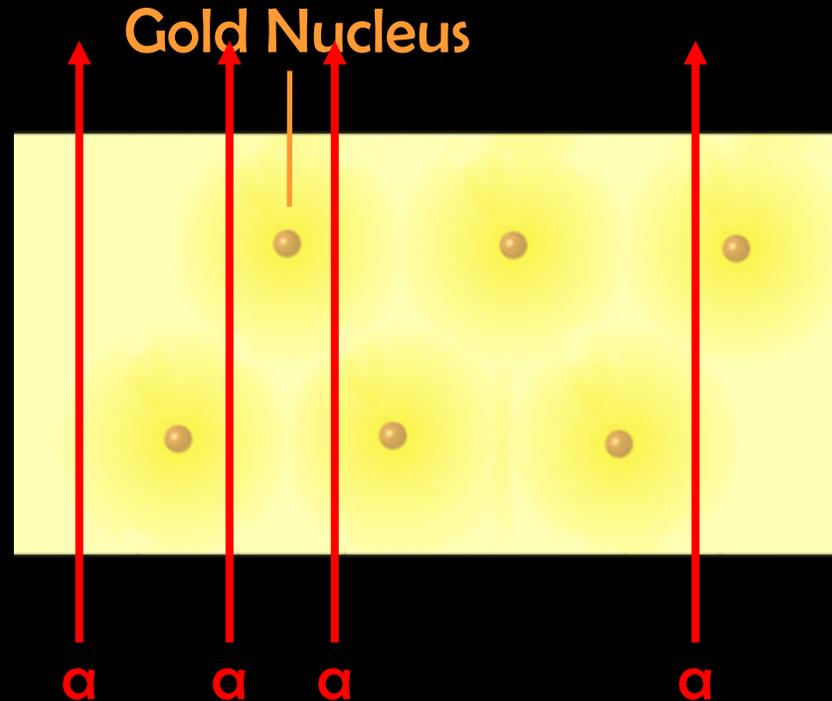


Screen

Most particles went  
right through!

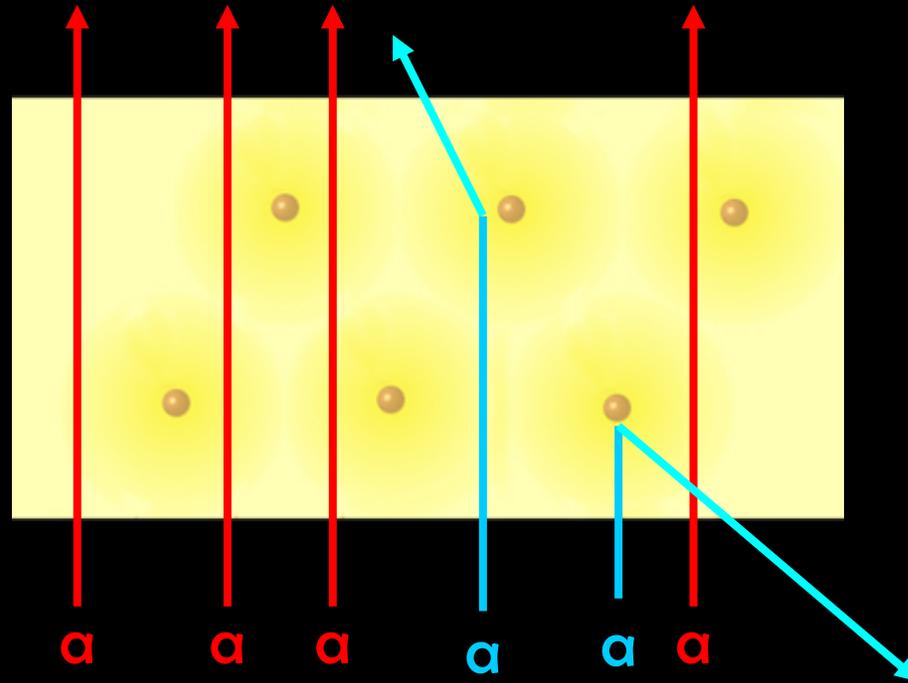
Strangely, some  
particles are deflected

# Rutherford's Experiment



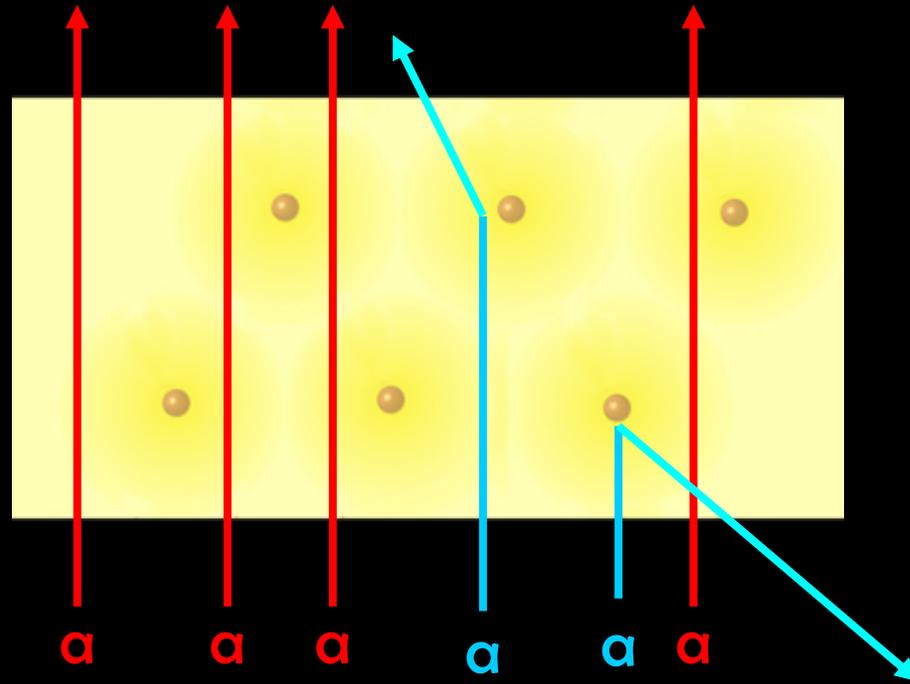
Most  $\alpha$  particles went through the gold.  
The atom is mostly empty space.

# Rutherford's Experiment



Some particles deflected and others even bounced back... this was crazy!

# Rutherford's Experiment

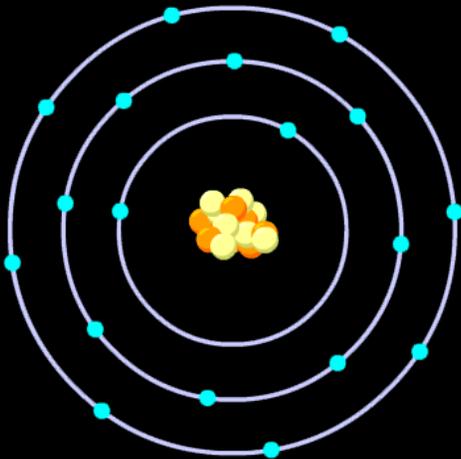


The atom had a very dense (+) center.  
Rutherford called it the nucleus.

# Niels Bohr (1913)

Niels Bohr improved on Rutherford's model.

He proposed that electrons move around the nucleus in specific layers, or shells.



Every atom has a specific number of electron shells.



# James Chadwick (1932)

Chadwick discovered neutrons.

Working with Rutherford, he discovered particles with no charge.



He called these particles neutrons.

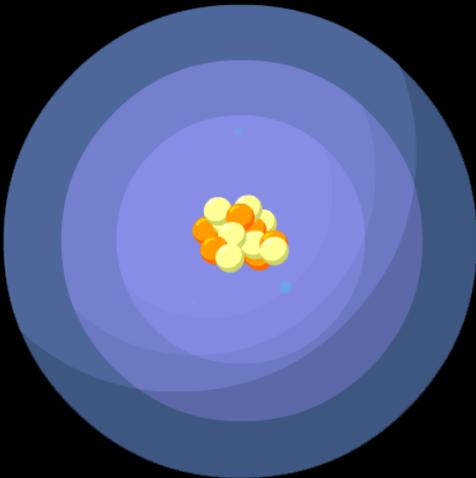
Neutrons are also found in the nucleus.



# The Modern Model (1932-)

Work done since 1920 has changed the model.

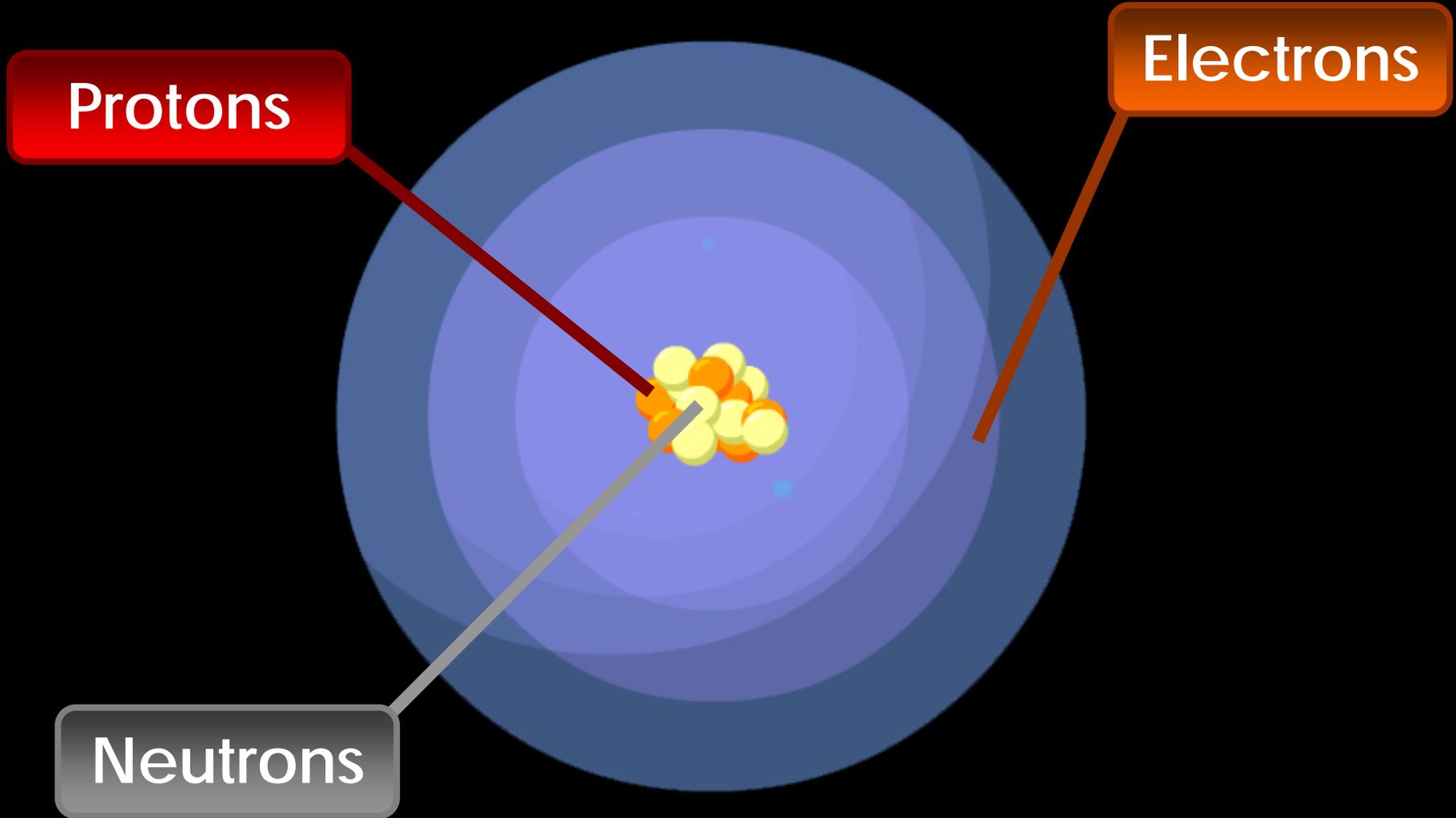
The new atomic model has electrons moving around the nucleus in a cloud.



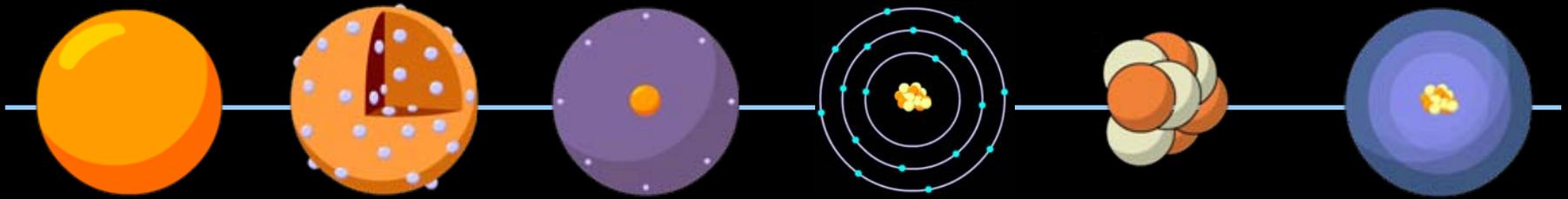
It is impossible to know where an electron is at any given time.



# The Current Atomic Model



# Atomic Theory Timeline



Dalton



Thomson



Rutherford



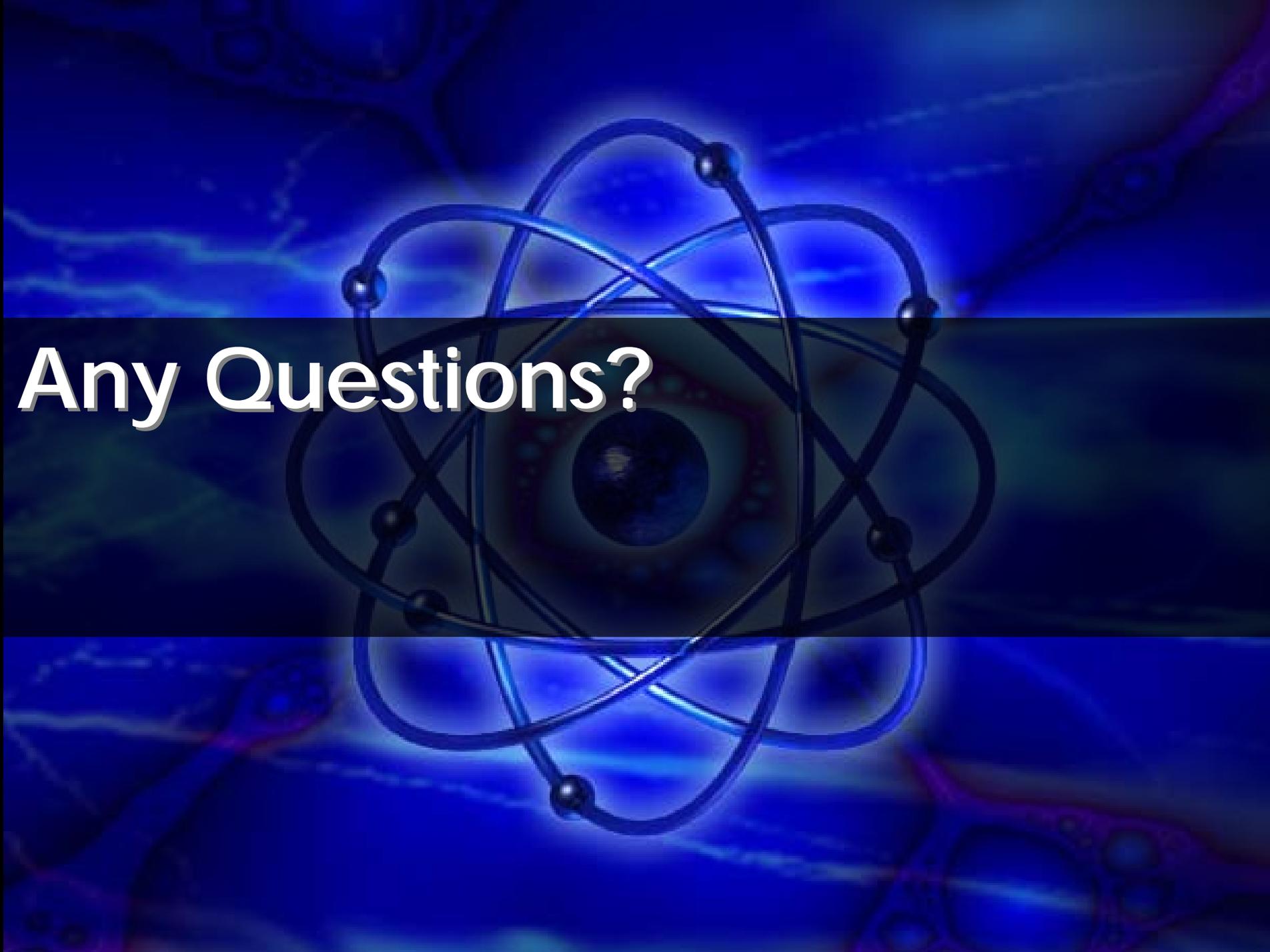
Bohr



Chadwick



Modern



**Any Questions?**