

1

Excited Gases & Atomic Structure

Electricity off.
Colorless gases.

Electricity on.
Excited electrons.

Gases such as neon are colorless. However, if electricity is passed through the gas, the atoms are excited, and the gas glows.

2

Atomic Line Emission Spectra and Niels Bohr

Niels Bohr
(1885-1962)

Bohr's greatest contribution to science was in building a simple model of the atom. It was based on an understanding of the **BRIGHT LINE EMISSION SPECTRA** of excited atoms.

3

Line Emission Spectra of Excited Atoms

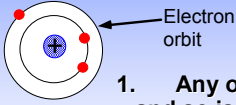
- Excited atoms emit light of only certain wavelengths
- The wavelengths of emitted light depend on the element.

Light source Focusing slits Prism Detector

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Atomic Spectra and Bohr

One view of atomic structure in early 20th century was that an electron (e-) traveled about the nucleus in an orbit.



1. Any orbit should be possible and so is any energy.
 2. But a charged particle moving in an electric field should emit energy.
- End result should be destruction!

Atomic Spectra and Bohr

Bohr said classical view is wrong.

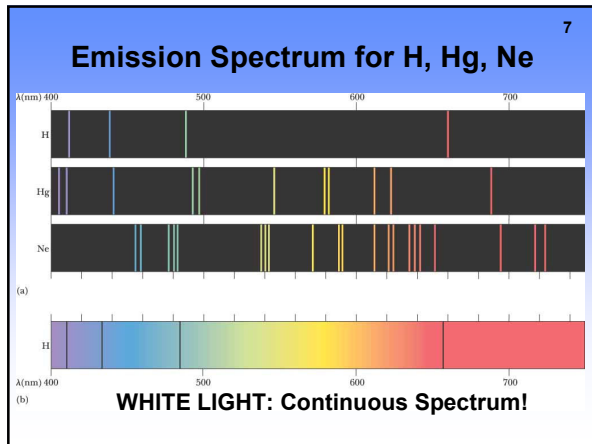
Need a *new* theory — now called **QUANTUM** or **WAVE MECHANICS**.

Electrons can only exist in certain discrete orbits and when the electron is **NOT** excited, it exists in the **GROUND STATE**.

The electron, in its particular energy level, has a certain amount of energy associated with it – called a **QUANTA**.


What happens when electrons “get excited”

- By running an electrical current through an atom (or, heating it up), the electrons **ABSORB** some of that energy and “jump up” to higher energy levels.
- This is called the **EXCITED STATE**.
- Electrons *want* to fall back down to their **GROUND STATE**.
- When this happens, the electrons give off that previously absorbed energy in the form of **LIGHT**.
- Since **ENERGY is proportional to FREQUENCY** ($E = h \times f$), we can see the bands of light!



8

Atomic Line Spectra and Niels Bohr



Niels Bohr
(1885-1962)

- Bohr's theory was a great accomplishment.
- He received Nobel Prize in 1922
- Problems with theory: theory only successful for H.
- introduced quantum idea mathematically.
- So, we go on to **QUANTUM** or **WAVE MECHANICS**
