

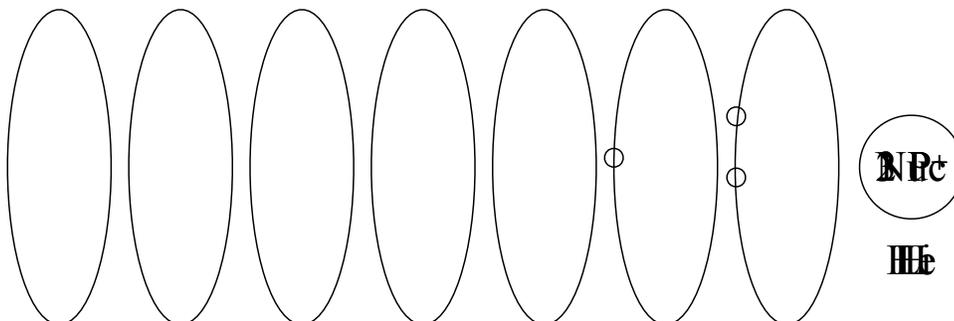
# Photoelectron Spectroscopy

## Photoelectron Spectroscopy

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### Important Background Understandings

- We must understand the forces that electrons “see” within an atom
  - Nuclear Charge ( $Z$ )
  - Shielding
  - Effective Nuclear Charge ( $Z_{\text{eff}}$ )



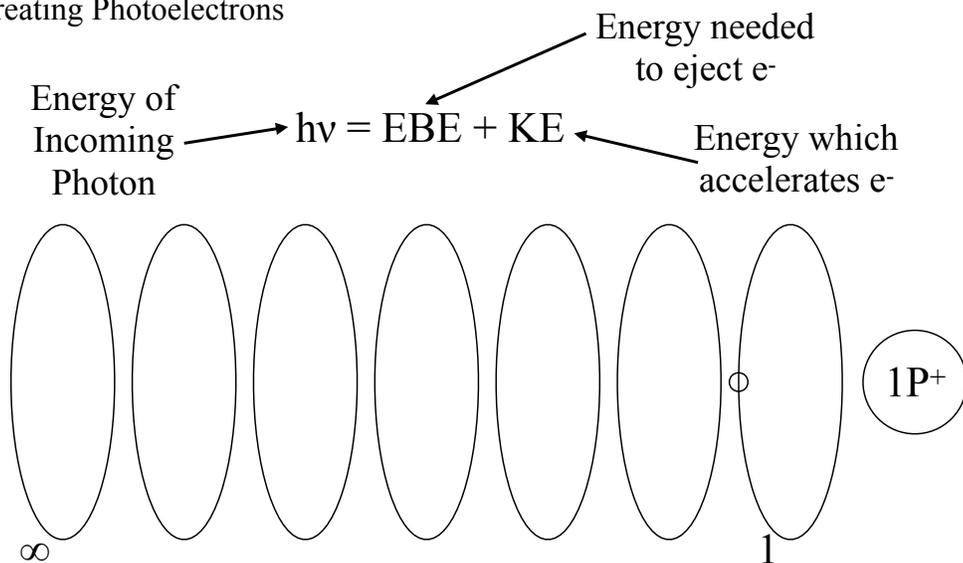
## Photoelectron Spectroscopy

### The PES Process - Creating Photoelectrons

- Photoelectrons
  - Electrons ejected by a substance due to energy added in the form of photons - many times x-rays
- Electron Binding Energy (EBE)
  - The amount of energy required for an electron to overcome the attractive force of the nucleus (effective nuclear charge).
  - For our purposes, it is the same as ionization energy

## Photoelectron Spectroscopy

### Creating Photoelectrons



## Photoelectron Spectroscopy

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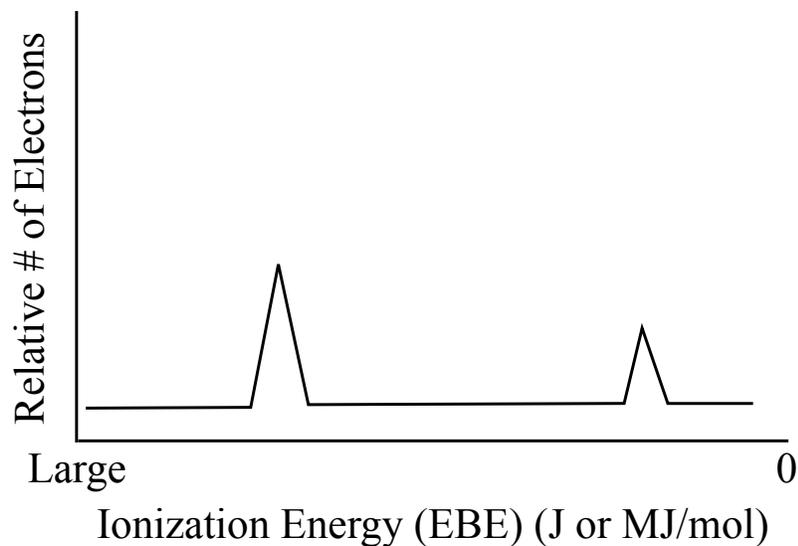
### Creating Photoelectrons

- If photons of sufficient energy ( $h\nu$ ) are used to bombard an atom, an electron may be ejected from any of the energy levels in an atom
- Each atom will eject only one electron, but every electron in each atom has an equal chance of being ejected
- In a large group of identical atoms, the electrons ejected will come from all possible energy levels
- Because the photons used all have the same energy, electrons ejected from any given energy level will all have the same kinetic energy
- Only a few different energies of ejected electrons will be observed, representing the number of energy levels (and sublevels) in an atom
- This data is then graphed in a *photoelectron spectrum*
  - A plot of the relative number of electrons ejected vs. the ionization energy of the electrons

## Photoelectron Spectroscopy

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### Photoelectron Spectrum



## Photoelectron Spectroscopy

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### Homework

- Draw the PES spectra for hydrogen through neon on the same graph, using different colors to represent each atom