Lecture 3.3 Light and Matter

Matter Basics
The number is written as a left superscript and is basically equal to the number of protons and neutrons.

The number is written as a left subscript and is equal to the number of protons. It is redundant with the symbol because the symbol also tells how many protons there are (by definition).

are atoms that have the same number of protons but different number of neutrons.

are atoms with a different number of electrons than protons.

are a set of atoms which are tightly bound together.

As a notation CI means Carbon. CII means singly ionized Carbon. CIII means doubly ionized Carbon. This notation is most common in astronomical circles. It is not a notation used by all fields (like Chemistry).

Atoms are mostly space.

Four Fundamental Forces
1. is the force that all masses exert on each other. Written as an equation it is

2. is the force that charges exert on each other. Written as an equation is:

3. is the force that keeps the nucleus together. It is very short ranged.

4. is the force that is involved in things such as nuclear decays. It is also very short ranged.
Energy Levels

Electrons are bound to atoms and their can be accurately described by quantum mechanics. Each electron bound to an atom can only occupy a discrete “state” which has a specific energy.

The ____________ state is the most bound state and has the most negative energy.

For a photon to interact with an electron is must have the right energy to either move the atom up to a higher energy level or ionize the electron.

________________ states are states where the electron occupies higher energy levels than the most negative state the electron can occupy.

When an electron is in an excited state it will spontaneously ______________ or ______________ (both terms can be used) to a lower state. When it does this it will release a _____________ with energy equal to the difference in energy of the two levels.

Spectroscopy

Each atom has a unique set of energy levels. Thus the photons that will be emitted by deexciting atoms will be unique. Atoms can be identified by their particular spectra.

__________ distort the energy levels of atoms (and molecules can be seen by their spectra too). However, the “denser” the material the more allowed energy levels there will be until eventually virtually every energy of photon will be emitted.