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Light Bulb Demo
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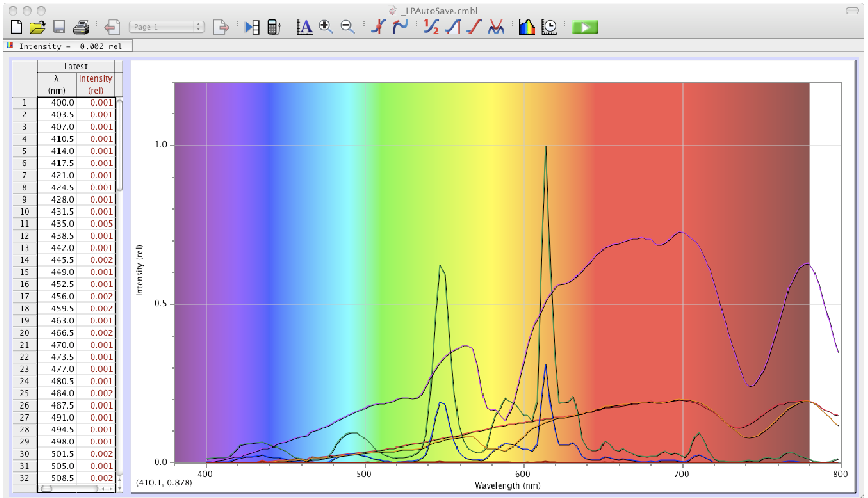

INCANDESCENT (and HALOGEN) BULBS

Incandescent bulbs have a tungsten filament in a sealed argon chamber that is heated via resistance. A halogen bulb is a type of incandescent light bulb in which the tungsten filament is placed in a quartz chamber filled with halogen gas. Both bulbs reach temperatures that vaporize the tungsten, though the quartz container of a halogen bulb can be heated to higher temperatures. In a traditional incandescent light bulb, the vaporized tungsten coats the inside of the bulb, and eventually weakness in the filament causes it to break. Halogen bulbs last longer than traditional incandescent bulbs because the halogen reacts with the vaporized tungsten, redepositing it on the filament.

Incandescent and halogen bulbs work by blackbody radiation. When heated, particles (in this case the tungsten atoms) vibrate and move, adding more quantum levels (there are a lot more energy transitions possible, corresponding to a greater range of wavelengths) that the excited electrons can relax down to. This causes the emission spectrum to appear continuous (which in fact it is not), rather than the jagged, quantized spectrum of a CFL. You can see that incandescent light has maximum intensity at those wavelengths that correspond to a reddish color or infrared light (700, 750 nm).

COMPACT FLUORESCENT (CFL) BULBS

Compact fluorescent bulbs work with much less energy. A ballast ensures that a steady voltage is applied to mercury gas contained within the bulb. This excites mercury's electrons. When the electrons relax, UV and some visible (in the blue-green range) light is emitted. This light is absorbed by the phosphor coating on the outside of the CFL bulb, making the phosphor's electrons excited. A small fraction of the energy is emitted as a photon of infrared (heat), and then the remaining energy is emitted as photons of visible light. This is the reason that the CFL spectrum is jagged and not continuous—the peaks correspond to the major energy transitions of the electron (relaxations). The highest intensity peaks in the emission spectrum occur at those wavelengths that correspond to green-yellow and orange-yellow light (550 nm, 610 nm).

Fluorescence differs from phosphorescent light emission in that it degrades more quickly, even after the source of excitation is removed, because there is no metastable state that "stores" electrons. Phosphorescent substances, in contrast, have two significant electronic transitions—first, a fast transition that loads up a metastable triple energy state, and then second, a slow transition that actually emits the visible light. Because the second transition is slower it is possible to see light emitted after the excitation source is removed.