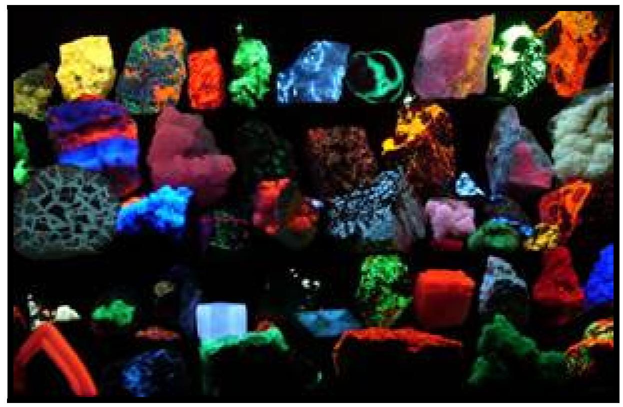
How Fluorescence Works: Why Certain Objects Glow Under Black Light

A brief explanation of how fluorescence works and how it applies to creating black light effects.

The photo on this page shows a collection of various fluorescent minerals under long-wave, medium-wave and short-wave UV. Many substances will react in the presence of UV light, giving off visible light in return. The materials "glow" because they are *literally* giving off visible light.



A collection of fluorescent minerals under long-wave medium-wave, and short-wave UV light. (Photo by Hannes Grobe)

A complete explanation of this phenomenon is beyond the scope of this tutorial. (It would take several chapters of a chemistry or physics textbook to explain it completely.) But we'll give a brief explanation here...

Remember the dual nature of light we mentioned in the last tutorial? When light comes into contact with an atom, it behaves more like a particle rather than a wave.

A "particle" of light is called a photon. It has no mass—just energy. You can think of it as a packet of energy. When this packet of energy (photon) comes into contact with an electron in the outer regions of an atom, the electron absorbs the energy and jumps to a higher energy state. It moves to a higher orbital, as physicists call it.

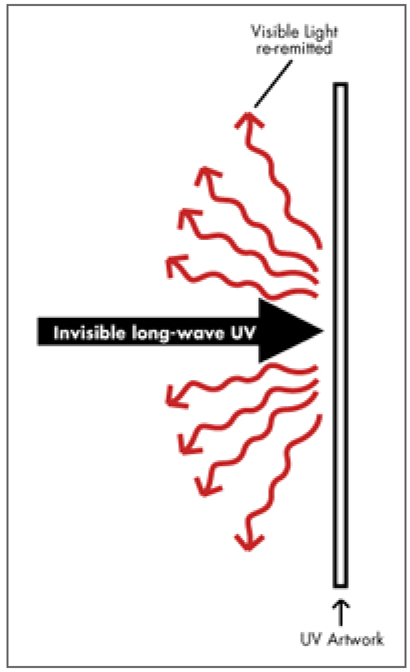
The electron doesn't stay there, though. It releases that energy as a photon of light. BUT…this new photon has a slightly lower energy level (and thus a lower wavelength).

Every substance interacts with light in this way. But typically we don't see it, because the light given off is either of a wavelength we can't see, or there is so much ambient light present that we don't see the visible light being emitted.

If it's a photon in the UV range striking an atom, and if the atom emits a visible photon in return, the material is UV sensitive. This is the glow effect associated with black light, and you typically can't see it unless there is complete darkness and you have an artificial light source emitting UV light. The more sensitive the material is, the brighter it glows. And the more UV light is applied, the brighter it glows still.

BUT, there's more to the story. You see, different so-called UV sensitive materials will react best to certain wavelengths. In the photo, you see minerals in the presence of long-wave, medium-wave, *and* short-wave UV light. In other words, the *entire range* of UV light was applied to get those materials to glow.

In entertainment applications, we're typically limited to long-wave UV, which is safe for our audiences, customers, or friends. So in choosing UV sensitive materials, we'll want materials which react best under long-wave UV light. And that's exactly what black light sensitive products are designed to do (although some are better than others.)



When selecting a fixture, it's been our experience that you'll get the best results—the brightest effect—with a fixture peaking at around 365nm. *Right smack in the middle of the long-wave UV range.*

When you think about it, it makes sense: This wavelength represents a compromise. Any fixture will emit a *range* of frequencies. Not just one. So if a fixture peaks in the middle of the long-wave UV range, you're covering the entire spectrum of black light...*and* getting the most out of your UV-sensitive materials.