Re: White LED Flashlight vs. Halogen

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<crossposted to sci.optics>

zach wrote:

>Hi− I have recently picked up some LED flashlights, being sold on the
>idea that the bulbs will last longer than the light, and they have
>much lower power consumption than filament bulbs. I am kind of
>dissappointed, however, in the intensity of the light. I have a little
>portable light (one LED) that takes two 1.5V cells. It seems like it
>is bright when I shine it into my eyes, but it does not seem very
>bright when shining it on objects. I used it when I went into a pitch
>black mine, for instance, and it was truly pathetic. Luckily, we had
>brought along a large halogen mag. light... It does reflect nicely off
>of the retinas of deer at night (and they didn't seem bothered by it,
>stupid deer).
>
>So, I bought a larger flashlight (with 2D cells) that has four LEDs.
>It does seem _almost_ as bright as the standard mag. light (which has
>4 Ds for power supply, but one bulb), and hurst to look at, but has
>very poor reflectance off of objects. I looked up something on white
>LEDs and saw that it is basically a blue LED, with a high peak at
>around 460 nm, which excites a weaker, broad yellow peak... mixed
>together the eye apprehends as white. The blue peak seems to be at
>about 9% range of light sensitivity for the human eye. Therefore, I
>would conclude (and this is my question) that the reason it seems to
>bright to me is because of that high intensity peak near the lower end
>of the wavelength detectability of my eyes. At a young age, I noticed
>that black lights seem to "feel" brighter than they are when looking
>directly at them (now and then, I didn't make a habit of it), but
>didn't really seem "bright". I assumed this was because their peak
>intensity was well below that of human eye detectability.
>
>And this segues into the related question... that of emissivity. I
>assume that the reason the "white" LED flashlight does not seem that
>intense when illuminating other objects, especially where no other
>light sources are present (like the mine), has something to do with
>emissivity wrt the light source. The halogen white−yellow illuminates

>external objects nicely, but the "white" LED is kind of weak. Can
>someone give a brief explanation of this (if my assumption is correct)
>comparing the two light sources? Thanks for any input or corrections.
>
>Z.
>
>
Ah, a real−world application of phots and nits!

LED sources are nice because a lot of the electrical power (something like 10%, IIRC) is converted into visible photons. LEDs are "efficient" when compared to typical incandescent (halogen) bulbs (only something like 0.1% of electrical power ends up as visible light). And, because LEDs are solid state, they don't burn out− 100 khour lifetimes are standard, I think, as compared with about 1 khour on an incandescent.

But... The total amount of light energy coming out of an LED is less than an incandescent, generally. Industrial−strength LEDs are around 100 mW:

http://www.lumileds.com/products/family.cfm?familyId=9

Lumileds claims to sell the brightest LED in the world. Note they quote brightness in terms of 'lumens', not Watts: hence the first line of my reply. I'm not going to bore you with the specifics, let's just say manufactuers like to use 'lumens' and 'candelas' when they want to confuse the typical buyer. Not sure what the rating is on a flashlight LED, but let's say 10 mW. Say the halogen bulb burns through 4 'D' cells in 1 hour, (18 W*hr/D cell), means the halogen bulb is consuming about 80 Watts, which means 0.8 W = 800 mW visible energy, considerably more than the LED.

As for why the LED is bright when you look directly at it versus the reflection, LEDs emit light in a highly directional way, so that can explain why you notice the difference.

In any case, I suspect LEDs or their various bretheren (OLEDs, etc) will eventually replace fluorescent lights− not sure about incandescents due to source color issues, which you allude to in paragraph 2.

−−
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tanspose 'op' for mail