Additive Color Review

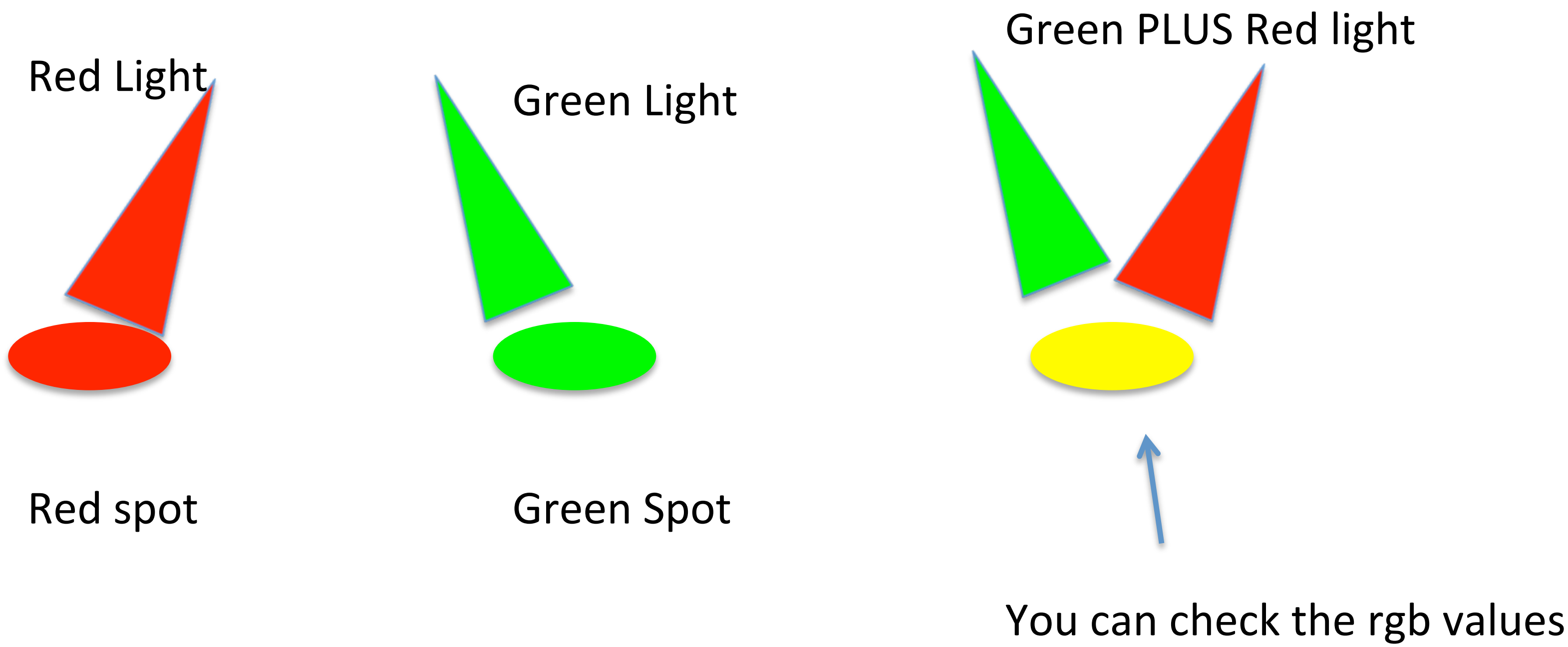
Throughout this course, you should always be trying to go back and forth among pictures, words and graphs.

When you see a picture or a graph, try to say in words what all is being shown.

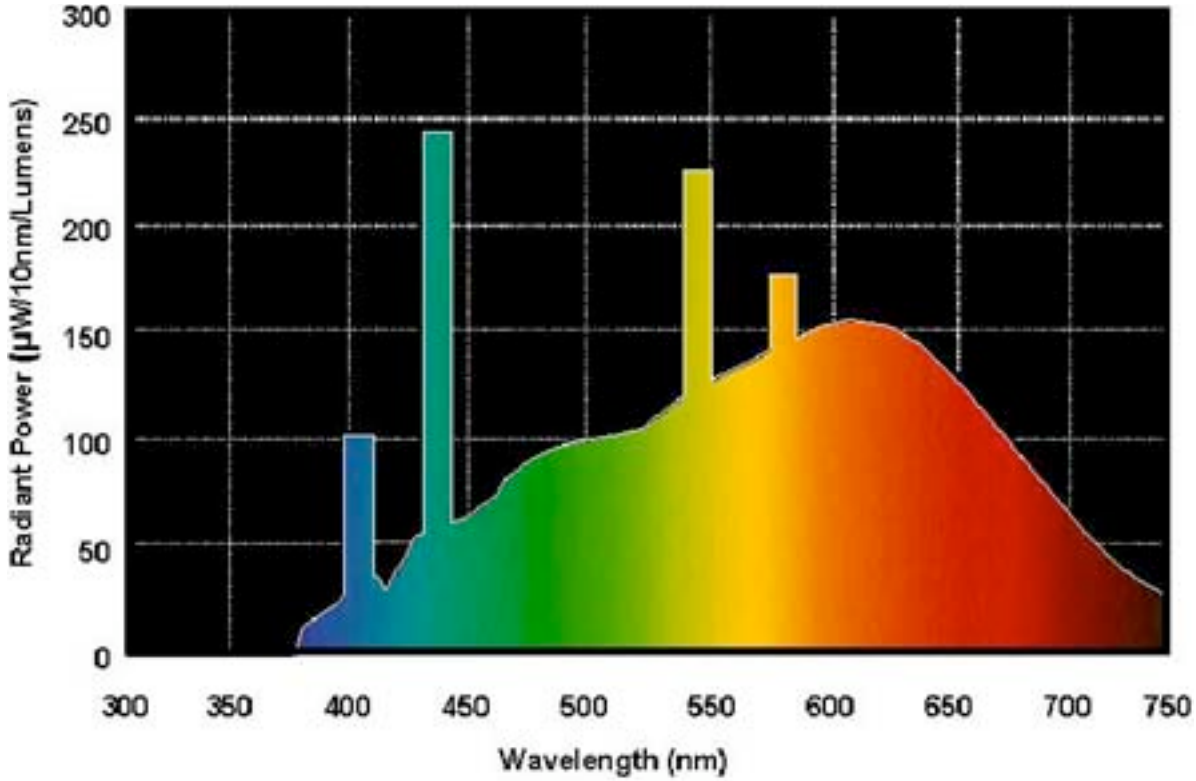
When you read words, think about what you could picture or graph.

In this presentation the difference between thinking about the spectrum in terms of wavelength and thinking about the spectrum in terms of color will be emphasized.

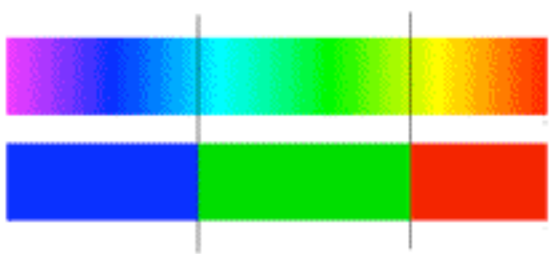
By the end, you will learn the concept of METAMER.



What do we have to add to the light spot to get white?



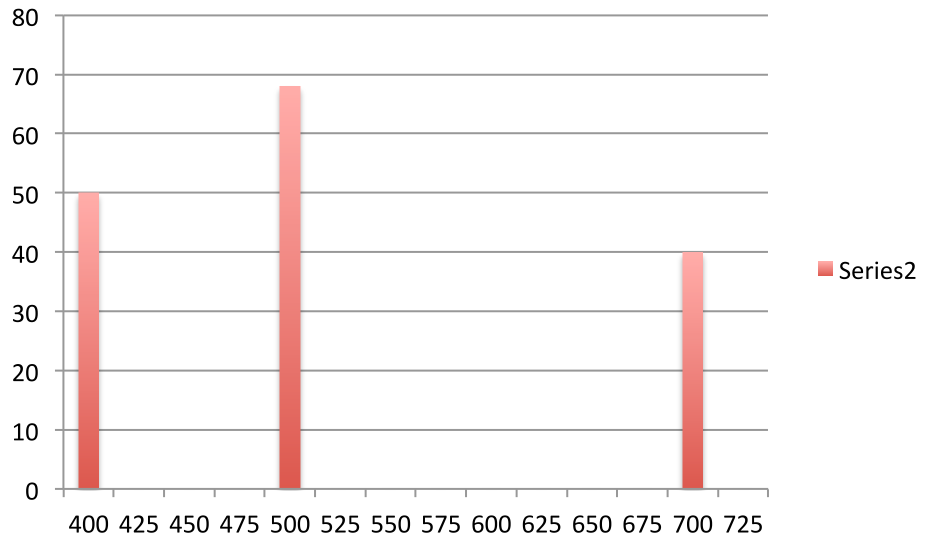
Here is a “white” light from the GE series. What does it show?



Here is the caricatured illustration you Linked to from our Jan. 30 class. Number 4.

Remember that “all” of the wavelengths in one spot yields white.

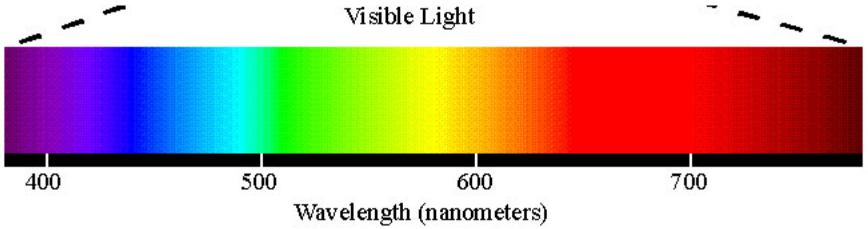
Interesting Question



What color is a light beam that consists of only these 3 wavelengths?

We do not have ALL of the wavelengths, but we do have the primary colors.

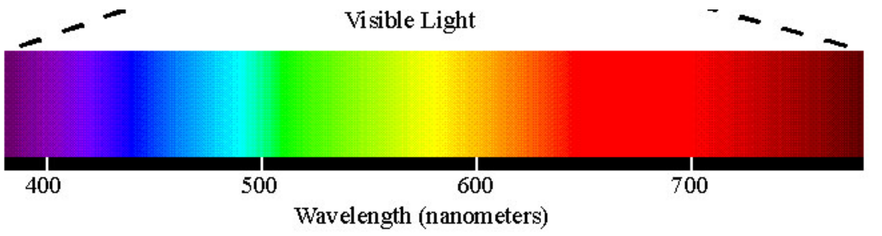
We have to get very serious about keeping color and wavelength separate!



Suppose that the top band represents the whole spectrum and the numbers underneath are wavelengths.

Illustrations like this suggest that the x-axis, representing wavelength, is all whole numbers, like 400, 401, 402, 403 etc. There's just not room to show them all. In the example on this page, there are only 4 numbers written down [400, 500, 600, 700]; but you know very well that all the numbers are intended.

However, it is worse than that. The wavelength dimension is continuous and includes all of the real numbers (every decimal number that could be expressed as a fraction of integers). That means that you are REALLY supposed to understand that there can be wavelengths of 401, 401.1, 401.15, 401.157 and so on. It is obviously impractical to put all of the numbers on the axis, so people usually do things like the picture above --- just show you the location of the key numbers and ask you to understand that all the others in between are there as well.



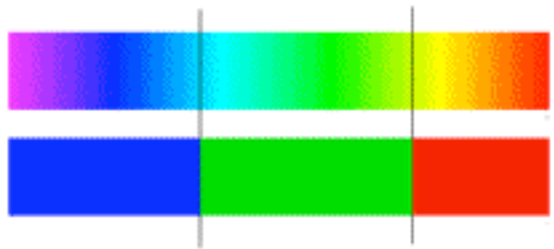
Now consider the spectrum, spread out on top of the numbers.

The suggestion, again, is that the colors in the spectrum vary with the wavelengths. That means:

For every wavelength, there is a place on the spectrum that has a corresponding color. OK?

The spectrum, as a series of colors, is continuous. The spectrum as a series of numbers is continuous.

If, in an optics laboratory, an experimenter can shine a beam of light at a given wavelength, the spot on the wall from that light beam will have a particular color, which will be about the same color for all people with normal color vision.

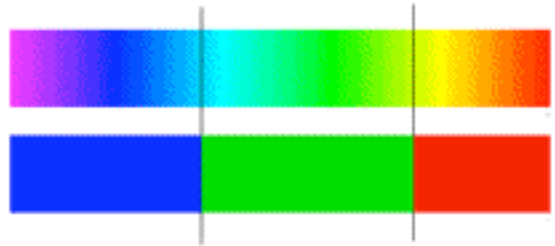


Remember this comparison from the Jan. 30 class [item numbered 4], also shown on the second slide of this set.

We said, after Isaac Newton, that the three primary colors, shown on the bottom bar above, could mix together to make all of the colors in the spectrum indicated by the top bar above.

That is, with 3 primaries, all of the colors of the rainbow (spectrum) can be made.

Remember that the rgb coding on your computer colors is an example of this fact, that all colors of the rainbow can be made with 3 primaries.



When we make spectral (rainbow) colors by mixing primaries, we are saying that all of the colors on the top bar can be created by mixing the 3 colors on the bottom bar. That means that for any color in the spectrum at the top, a mixture from the primaries at the bottom, can be made to match it.

This means that rainbow colors can be made in two <u>or more</u> ways. We could mix a red and green light to make yellow.
OR we could have a single wavelength from the spectrum that looks yellow.

If the same (LOOKING) yellow can be made in at least two different ways, we call these two ways (in terms of wavelength mixture), METAMERS.