

Title: Physics in Nature Presentation: Physics in Colour: The Mechanism of Its Formation and Colour Management

Date: Aug 19, 2011 03:45 PM

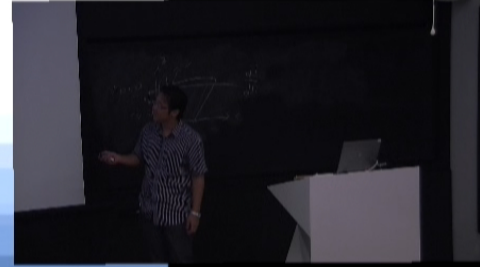
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Abstract:

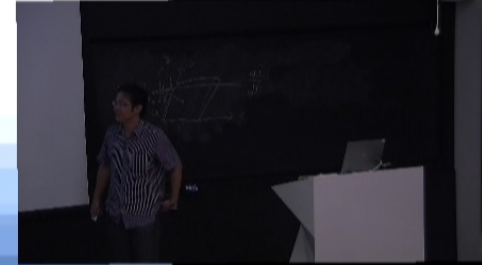
# Physics in Color

The Mechanism of Its Formation  
& Color Management

*Ye (Ellis) Yuan*  
*Aug. 19, 2011*



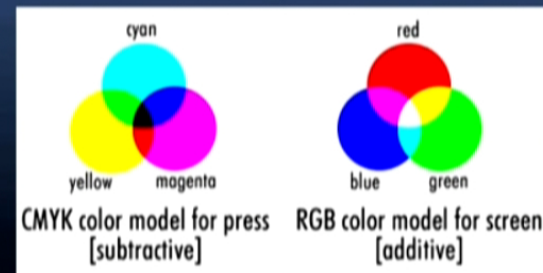
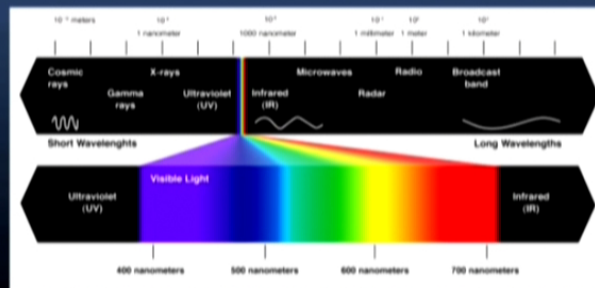
# Motivation



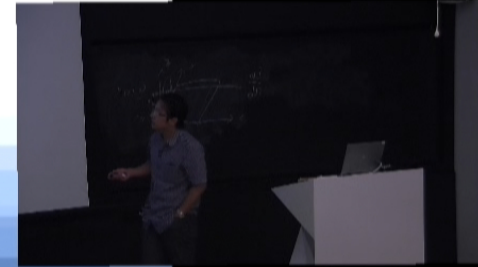
- An “Extra Dimension”,  
Preference for Colors; The size of pictures; The memory
- Need for photography, control over colors  
Unexpected photographs?  
Appearing the same to dogs, or birds?  
How to make it more appealing to the eye?
- Others  
Is it weird that the logo of a brand appears the same all over the world?

# A preliminary question

- How to measure colors?  
1D, 3D, 4D, or ?D; colors are actually not so linear-like as what we may think at first glance.

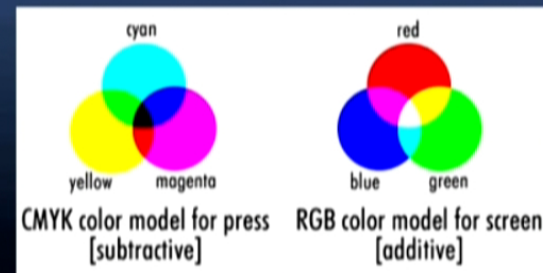
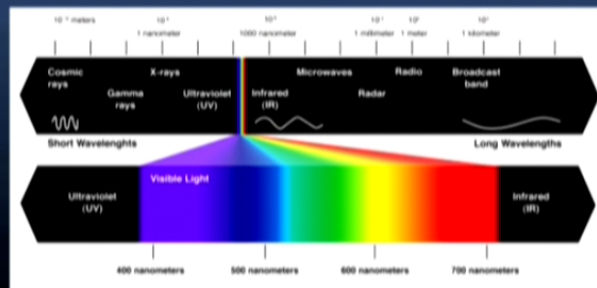


- This is misleading: **WAVELENGTH  $\neq$  COLOR**  
no wavelength for white and black

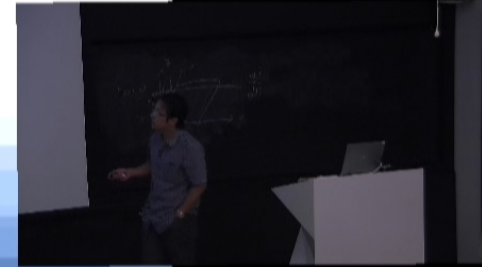


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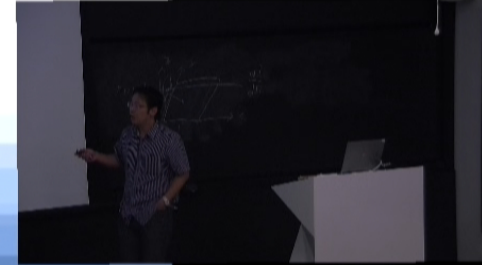


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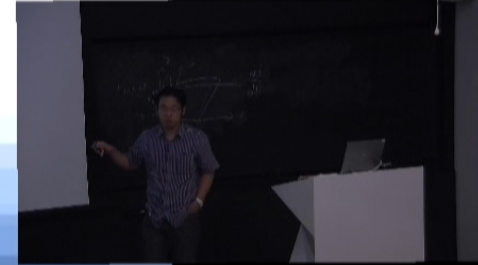


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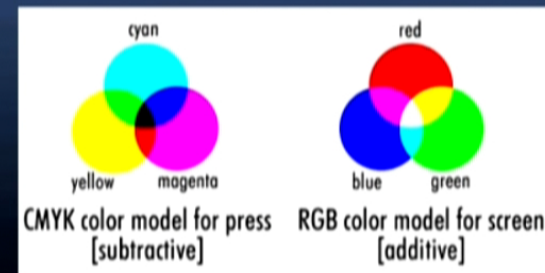
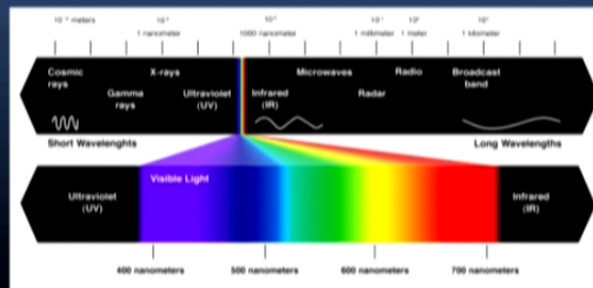
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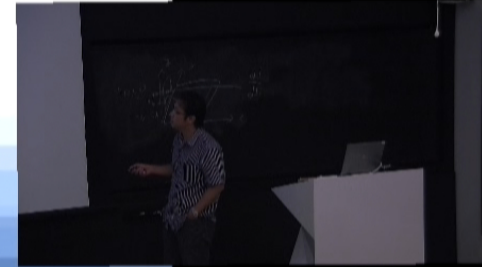
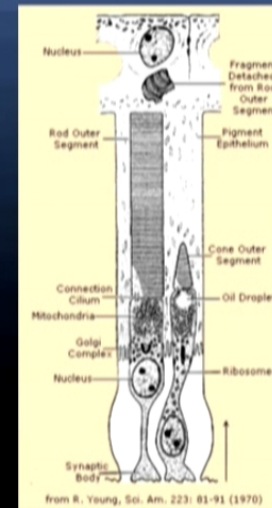
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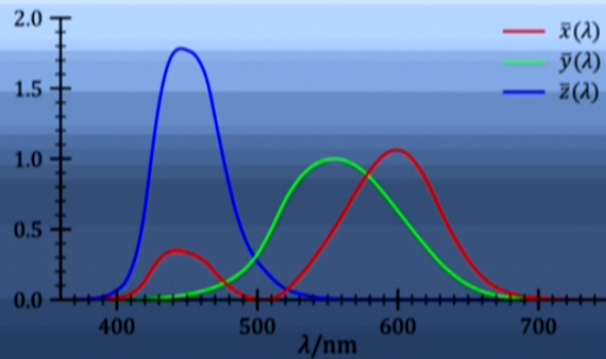
# Formation of colors

- Color is nothing before the light turns into signals in our nervous system via photoreceptor cells in our eyes.
- Photoreceptors only signals presence of light in our visual field.
- They responds to both wavelength and intensity of the light.
- There are basically three types of pigments in the photoreceptors in human beings' eyes.

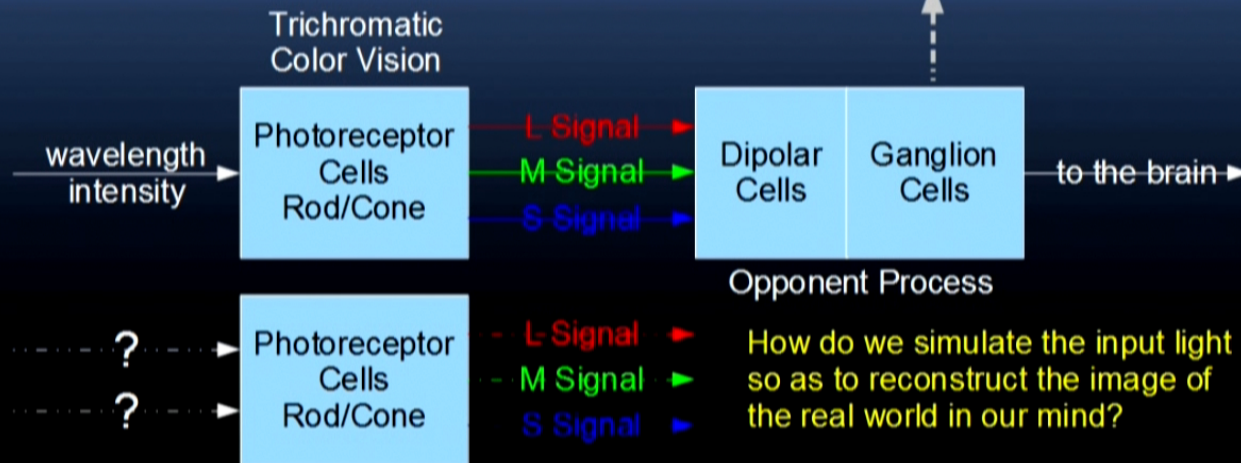




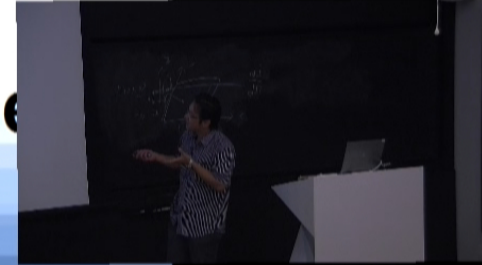
# Formation of colors



- Parvocellular:
1. L vs M, red-green difference
  2. S vs M+L, blue-yellow difference

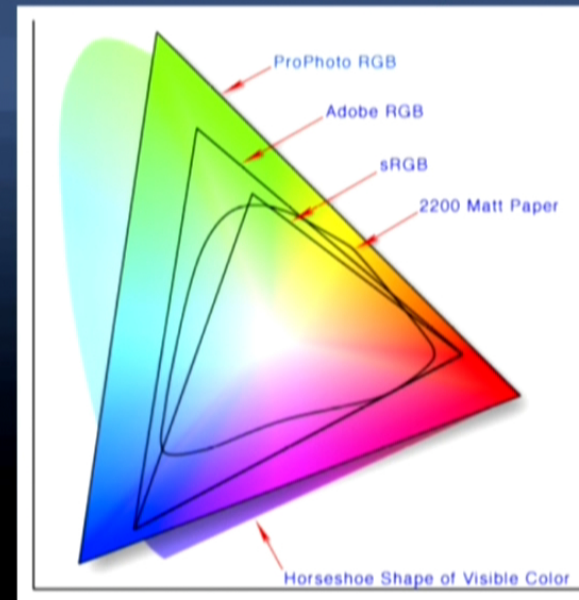


# Simulation: Standard, Color Space



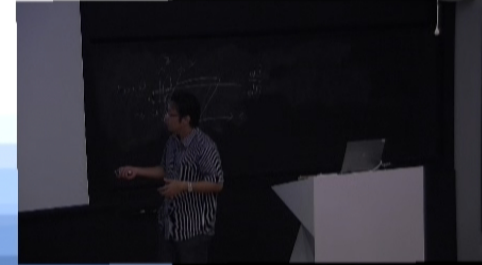
- Different ways of parametrization (Color Models):  
CIE XYZ/CIE LAB  
RGB(R,G,B)  
CMY/CMYK(C,M,Y,K)  
HSV/HSL(Hue,Saturation,Brightness)
- Customized for different applications

## Different Color Spaces



## Difficulties in simulating the real world

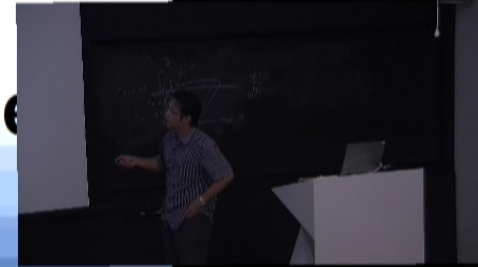
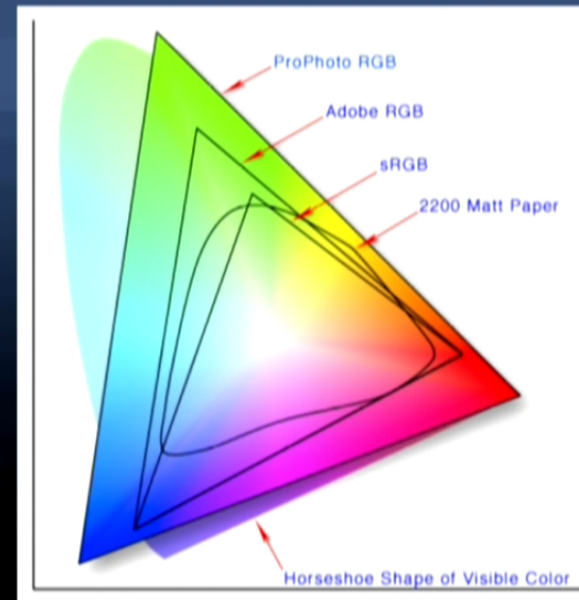
- Device that can measure the intensity in all wavelengths, and keeps a fast speed at the same time?
- Space required to store an image?
- Suitable output devices?



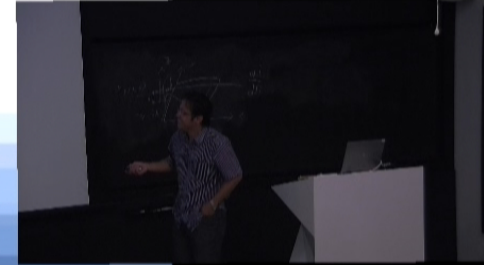
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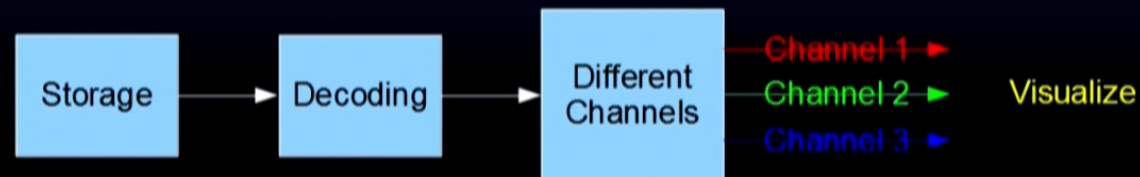
## Different Color Spaces



# Simulation: Reconstruction



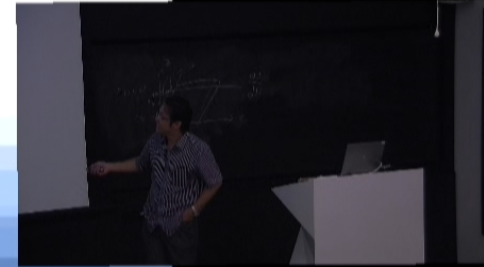
- Reconstruction of an image is not to bring back the whole reality, but merely to stimulate signals in our nervous system as similar as the real world does.
- The entire system is designed and customized for human eyes.



# Conclusion

- The best color management solution, with which we may easily handle the colors?

**NONE**



Thank you very much!

