ECE 637 Lab 6 Report

Introduction to Colorimetry

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Section2 – Plotting Color Matching Functions and Illuminants

2.1 The plot of the $x_0(\lambda)$, $y_0(\lambda)$, and $z_0(\lambda)$ color matching functions
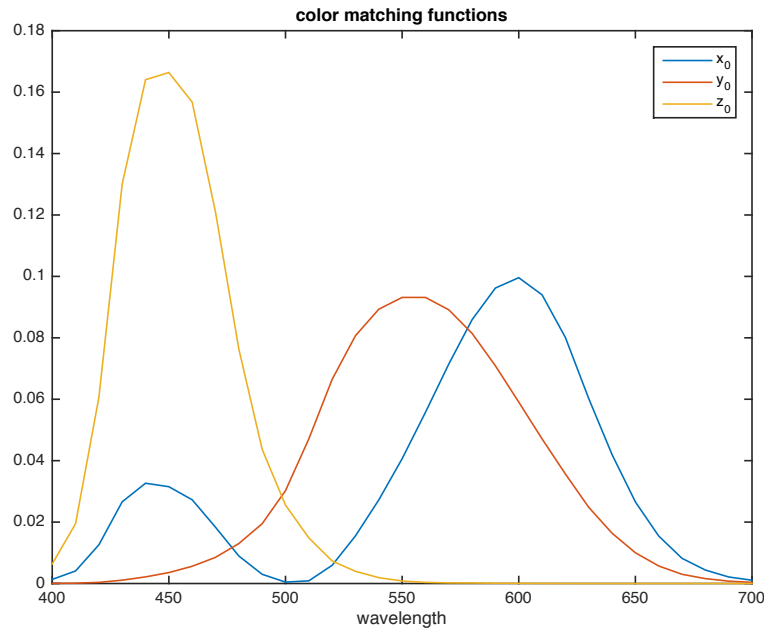

Fig 2-1 Color matching functions versus wavelength

2.2 The plot of the $l_0(\lambda)$, $m_0(\lambda)$, and $s_0(\lambda)$ color matching functions
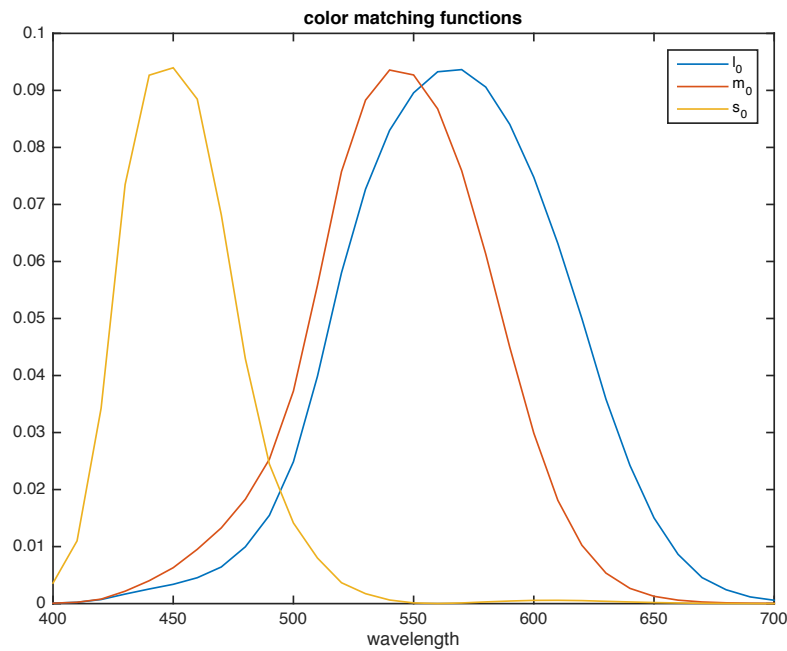

Fig 2-2 Color matching functions corresponding to the long medium and short cones versus wavelength

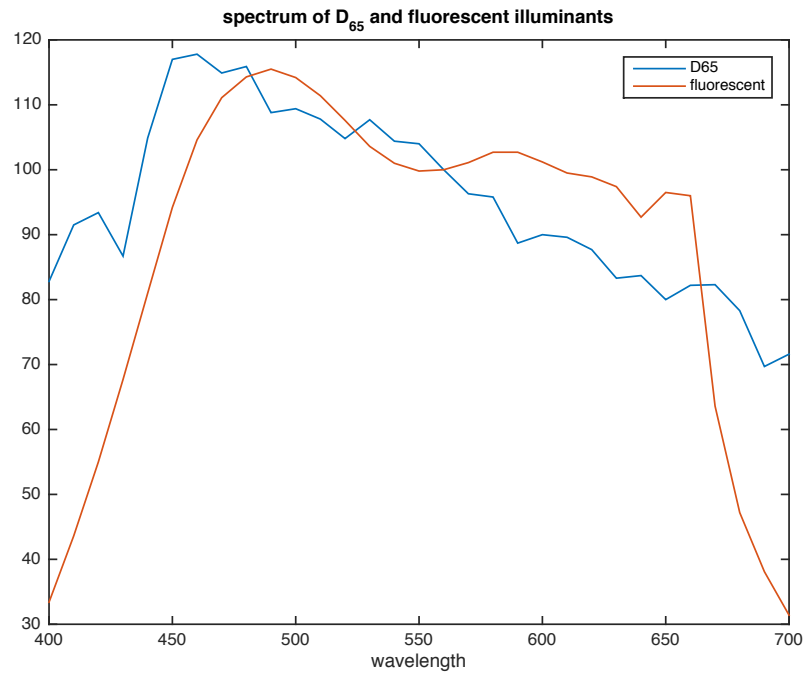## 2.3 The plot of the D_{65} and fluorescent illuminants

spectrum of D_{65} and fluorescent illuminants

Fig 2-3 The spectrum of the D_{65} and fluorescent illuminants versus wavelength

Section3 – Chromaticity Diagrams

3.1 Labeled chromaticity diagram
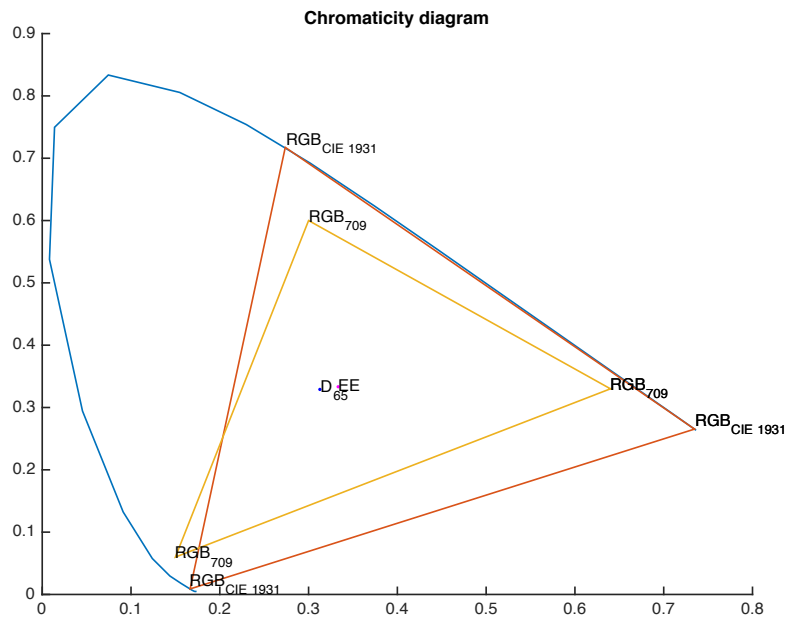
Chromaticity diagram

Fig 3-1 Chromaticity Diagram

Section4 – Rendering an Image from Illuminant, Reflectance, and Color Matching Functions

4.1 The matrix M_{709_D65}

We know that the XYZ tristimulus values for the primaries will be related to the chromaticities through a set of scaling constants k_r, k_g, k_b and represented as

$$M = \begin{bmatrix} X_r & X_g & X_b \\ Y_r & Y_g & Y_b \\ Z_r & Z_g & Z_b \end{bmatrix} = \begin{bmatrix} x_r & x_g & x_b \\ y_r & y_g & y_b \\ z_r & z_g & z_b \end{bmatrix} \begin{bmatrix} k_r & 0 & 0 \\ 0 & k_g & 0 \\ 0 & 0 & k_b \end{bmatrix}$$

and if we know the white points, we can get scaling constants k_r, k_g, k_b by

$$\begin{bmatrix} k_r \\ k_g \\ k_b \end{bmatrix} = \begin{bmatrix} x_r & x_g & x_b \\ y_r & y_g & y_b \\ z_r & z_g & z_b \end{bmatrix}^{-1} \begin{bmatrix} x_{wp}/y_{wp} \\ 1 \\ z_{wp}/y_{wp} \end{bmatrix}$$

So we can plug the $\begin{bmatrix} x_r & x_g & x_b \\ y_r & y_g & y_b \\ z_r & z_g & z_b \end{bmatrix}$ values and $\begin{bmatrix} x_{wp}/y_{wp} \\ 1 \\ z_{wp}/y_{wp} \end{bmatrix}$ values into the above

function, and get the $\begin{bmatrix} k_r \\ k_g \\ k_b \end{bmatrix}$ values. Then the last step is plugging

$\begin{bmatrix} x_r & x_g & x_b \\ y_r & y_g & y_b \\ z_r & z_g & z_b \end{bmatrix} and \begin{bmatrix} k_r \\ k_g \\ k_b \end{bmatrix}$ into the first function, and get

$$M = \begin{bmatrix} 0.4124 & 0.3576 & 0.1805 \\ 0.2126 & 0.7152 & 0.0722 \\ 0.0193 & 0.1192 & 0.9505 \end{bmatrix}$$

4.2   The two images obtained from D_{65} and fluorescent light sources

Fig 4-2-1 Image obtained from D_{65}

Fig 4-2-2 Image obtained from fluorescent light sources

4.3　A qualitative description of the differences between the two images

The image obtained from D_{65} (image A) is much cooler than the image obtained from fluorescent light sources (image B). Image B is brighter and warmer than image A.

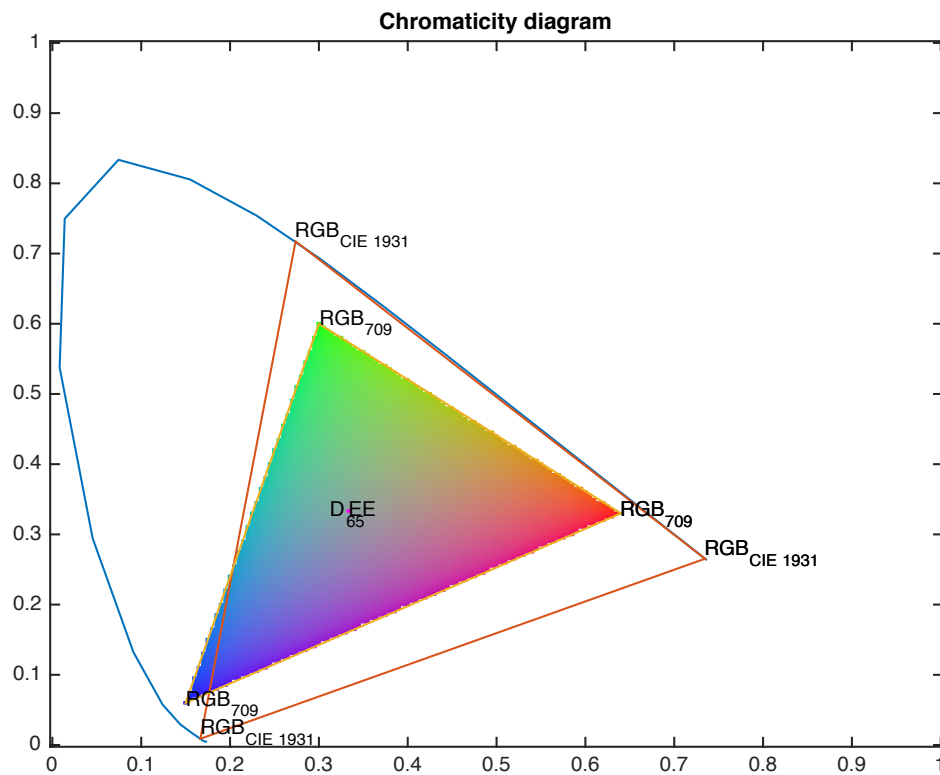## Section5 – Color Chromaticity Diagrams
5.1　Color diagram

Fig 5-1 Color Diagram