Natural Color Representation

- All we need to do for creating a “perfect” image of a complex scene, is creating a stimulus that will look identical

The RGB color space is highly suitable for image capturing and image representation.
**RGB drawbacks**

- High correlation between the three channels (we store/transfer redundant information)
- Couples the notion of **hue** with that of **luminance**

![RGB drawbacks diagram](image1)

**The HSV Color Model**

- Hue, saturation, value (brightness)
- Hexcone subset of cylindrical (polar) coordinate system

![HSV color model diagram](image2)

**The YIQ & YUV Color Models**

- Recoded RGB for transmission efficiency, compatibility with B/W broadcast TV
- \( Y = \text{CIE's } Y \) (luminance); \( I, Q \) encode chromaticity

\[
\begin{bmatrix}
Y \\
I \\
Q
\end{bmatrix} =
\begin{bmatrix}
0.30 & 0.59 & 0.11 \\
0.60 & -0.28 & -0.32 \\
0.21 & -0.52 & 0.31
\end{bmatrix}
\begin{bmatrix}
R \\
G \\
B
\end{bmatrix}
\]

**The HLS color Model**

- Hue, lightness, saturation
- Double-hexcone subset

![HLS color model diagram](image3)

**The HSV Color Model**

- Colors on \( V = 1 \) plane are not equally bright
- Complementary colors \( 180^\circ \) opposite
- Saturation measured relative to color gamut represented by model which is subset of chromaticity diagram:
  \( \rightarrow \) therefore, 100% \( S \neq \) 100% excitation purity

![HSV color model diagram](image4)
Color Matching

“perceptually uniform” color space

L*a*b* Space

- Non-linear model.
- More perceptually uniform than CIE-XYZ: ellipses are much closer to circles. As a result, Euclidean distance is useful.
  - L*: Lightness.
  - a*: Red-green content.
  - b*: Yellow-blue content.

Color Matching

- Fit curves to three functions that describe the matching—f(r), f(g), and f(b)