Crosstalk controls the range of colors in an image. [Figure 9]

Recent low-light experiments measured small color ranges using sub-optimally illuminated. [Shin, 2004; 6500°K; Cao, 2005; 5000°K].

The experiments in this paper used optimal spectral Illuminants [Figure 1, (McCann, 2006a,b)]. Here, we measured a wide range of colors from rod and Cone interactions.

The experiments matched 24 paper color squares [Figure 2]
(ColorChecker in low light) with (LCD display with 24 adjustable squares, above M- and S-cone thresholds).

5. Color matching data [Figures 3 – 8] shows:
A. Wide range of rod/Lcone colors fall on red cyan line.
B. Colors consistent with rod information sharing both M- and S-channels.

Start Display

Figure 2. Experiment: Observers viewed all 24 papers with their right eye. Alternatively, they viewed all areas on the the LCD display with their left eye, while adjusting each squares color.
The first pass took ~ 30 min. Observers continued matching until all areas are the best match, ~ 60 min.

Figure 3  Data Analysis: We used display digits to calculate display chromaticities. (left) Start image on display with R, G, B separations. (right) Triangles plot the display gamut.

546nm on rods

Figure 7 Matching digits for dim 546nm light that excites only the rods.

Note all RGB separations are the same.

Conclusions
In dim 546nm light matches fall on an achromatic point.
Add 625nm light to get a wide range of color matches.
Color matches fall within LMS cone color space.
The matches fall on a chromaticity line (3-D plane).
That line defines the rod (546nm) information pathway.
Colors show rods share both M- and S-channels.
The same is true for firelight.

Bibliography