LED Lighting and Astronomy/Ecology

- Shielding and Beam shaping
- Overlighting vs. Tuning of Levels
- Spectral Content
Light must be directed downward

Eliminate floodlights, wallpacks and other sources of glare and light pollution

There is an efficient, cost effective and properly shielded LED replacement for almost every legacy lighting system
The Difference is Visible

Fully shielded wallpacks

Unshielded aimed down floodlight

Unshielded aimed outward floodlight
No Excuses For Floodlighting!!!
Can You Find TUS now?
VIEW FROM 15 MILES AWAY
Before-Above; After - Below

10, 2014
Spectral Content Limits for Skyglow Controls are Inconsistent

- Chile: Max. 15% sub-500nm
- Cochise County AZ, Near LBT: 3000K CCT Max.
- Pima County AZ: 3500K CCT Max
- Canary Islands: Max. 15% sub-550nm

CCT is based upon Planckian Blackbody Radiator
### TABLE 1

Photometric and colorimetric properties of the light sources

<table>
<thead>
<tr>
<th>Light source</th>
<th>CCT (K)</th>
<th>Chromaticity coordinates</th>
<th>S/P</th>
<th>(M)LER (lm/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>x</td>
<td>y</td>
<td></td>
</tr>
<tr>
<td>LPS lamp</td>
<td>1814</td>
<td>0.5669</td>
<td>0.4324</td>
<td>0.23</td>
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<tr>
<td>HPS lamp</td>
<td>1886</td>
<td>0.5390</td>
<td>0.4104</td>
<td>0.54</td>
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<tr>
<td><strong>Firelight LED cluster</strong></td>
<td><strong>1859</strong></td>
<td><strong>0.5424</strong></td>
<td><strong>0.4101</strong></td>
<td><strong>0.49</strong></td>
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<td>Candlelight pc LED</td>
<td>2001</td>
<td>0.5215</td>
<td>0.4067</td>
<td>0.85</td>
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<tr>
<td>Warm white pc LED</td>
<td>2725</td>
<td>0.4582</td>
<td>0.4114</td>
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<td>Cool white pc LED</td>
<td>3991</td>
<td>0.3839</td>
<td>0.3893</td>
<td>1.39</td>
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<td>Daylight white pc LED</td>
<td>6084</td>
<td>0.3207</td>
<td>0.3287</td>
<td>1.92</td>
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<tr>
<td>CIE standard illuminant A</td>
<td>2854</td>
<td>0.4475</td>
<td>0.4074</td>
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</tbody>
</table>
S/P Ratio is a Better Metric

- Readily Measurable as Part of CIE/IES Testing Format
- Accurate metric for blue and green content
- Cited in several LP related research papers
- Can be field verified for conformance with handheld meter
Narrow Band Amber LED

0.3 S/P RATIO

Intensity (counts) vs Wavelength (nm)
Another source: Hybrid 80/20 NBA/2700K