

Better light sources for human-centric lighting

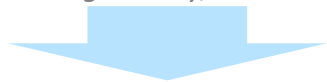
Wouter Soer

EPIC Online Technology Meeting on Human-centric Lighting and Applications
May 31, 2021

Human-centric lighting: meeting both visual and physiological needs



Not enough light during the day, too much light at night



Natural progression of light levels supporting healthy circadian rhythm

Focus on only **visual** requirements

- ✓ Illuminance / uniformity
- ✓ Color quality
- ✓ Glare

...does not always result in healthy lighting

Need to include **non-visual** requirements

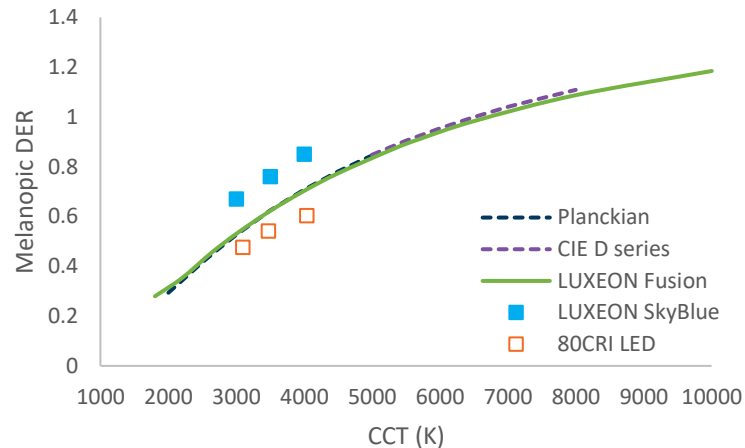
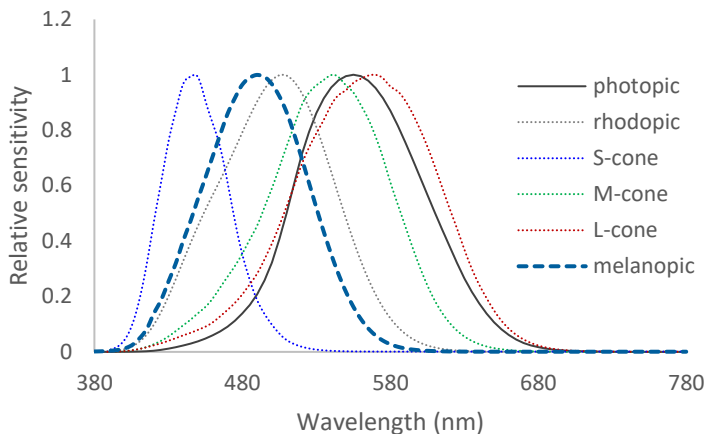
- ✓ Melanopic EDI (CIE S026:2018)

Recommended MEDI levels from [IWCNP 2](#)

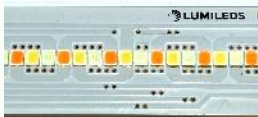
- > 250 lx daytime
- < 10 lx evening
- < 1 lx nighttime (sleep)

Light source **spectrum** and **spatial distribution** are key design elements

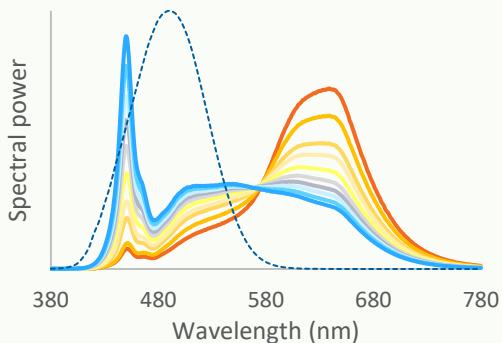
Spectrum



Tunable white LED modules enable up to ~3x dynamic range in melanopic EDI over practical CCT range



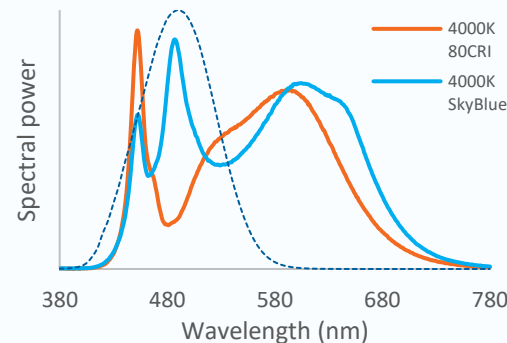
LUXEON Fusion



Engineered spectrum LEDs offer an additional ~1.5x dynamic range in melanopic EDI at constant CCT



LUXEON SkyBlue



Spatial distribution

- Spectral tuning alone is not enough to span a 25-100x range in melanopic EDI
- Need to increase / reduce light levels
- Requires different spatial distributions to maintain visual performance and efficacy

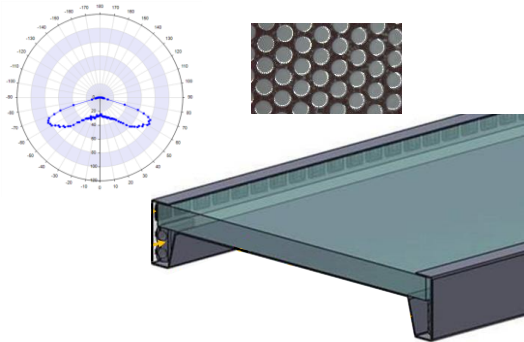


Light distribution for high ocular MEDI
Large overhead luminous surfaces in direct view

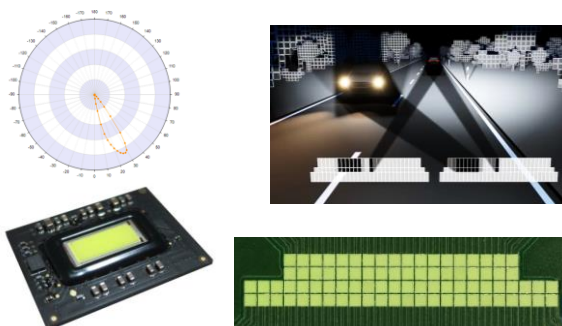


Light distribution for low ocular MEDI
Mostly indirect light, lighting only areas of interest

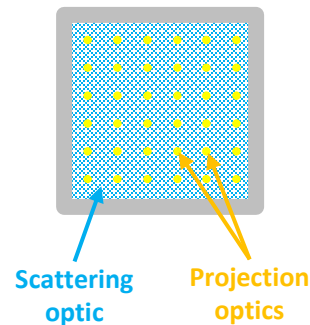
LED light engine technology for optimized spatial distribution



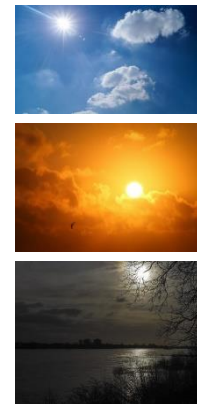
Light guide plates
for low-glare light sources



Digital projection mini/micro-LED modules
for adaptive beam shaping



Light engine integration





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