

Measuring Light Pollution with a Calibrated High Dynamic Range All-Sky Image Acquisition System

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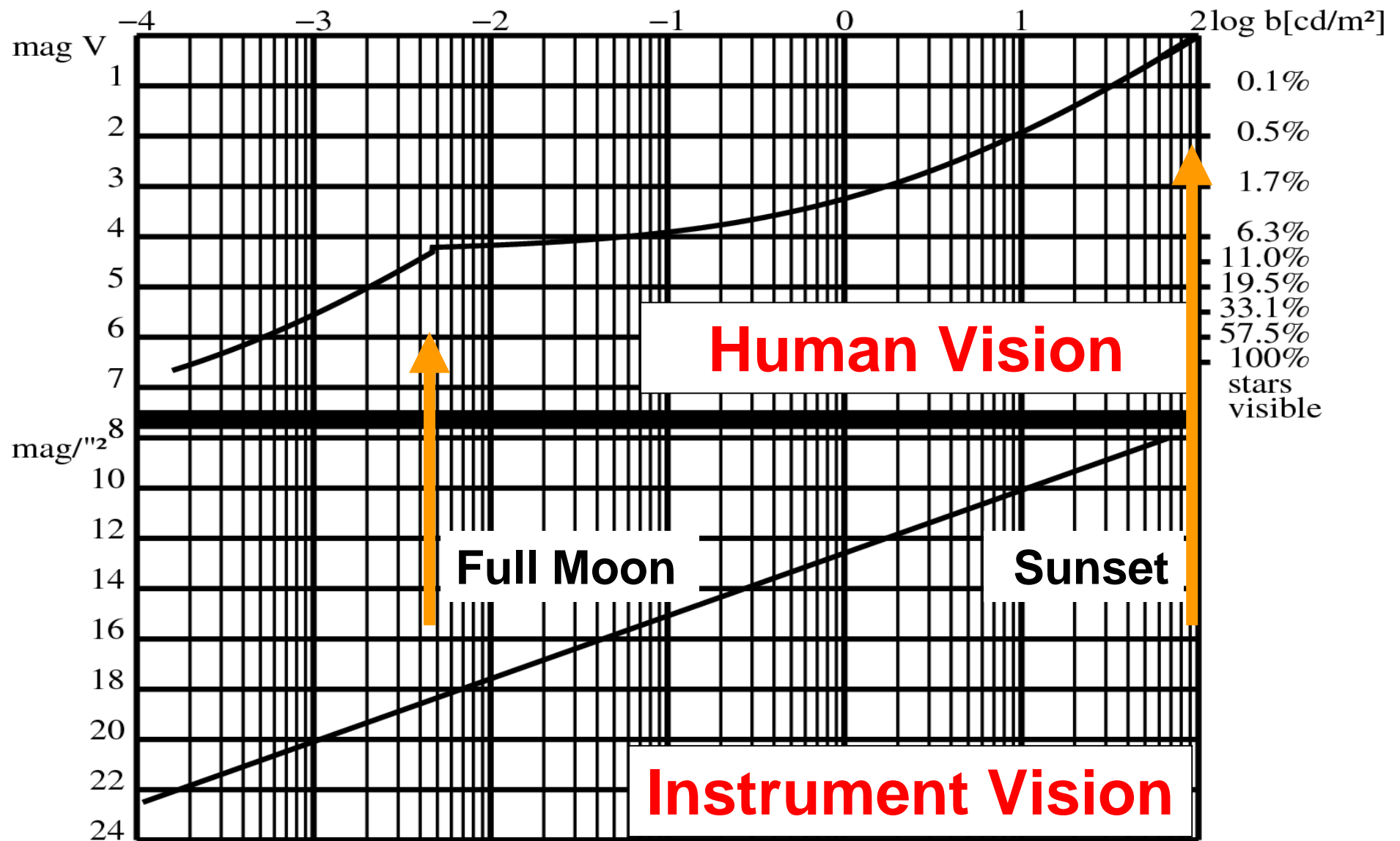
Vienna University of Technology



- Sky Luminance and Stellar Visibility
- High Dynamic Range Photography
- Evaluation of HDR images
- Results



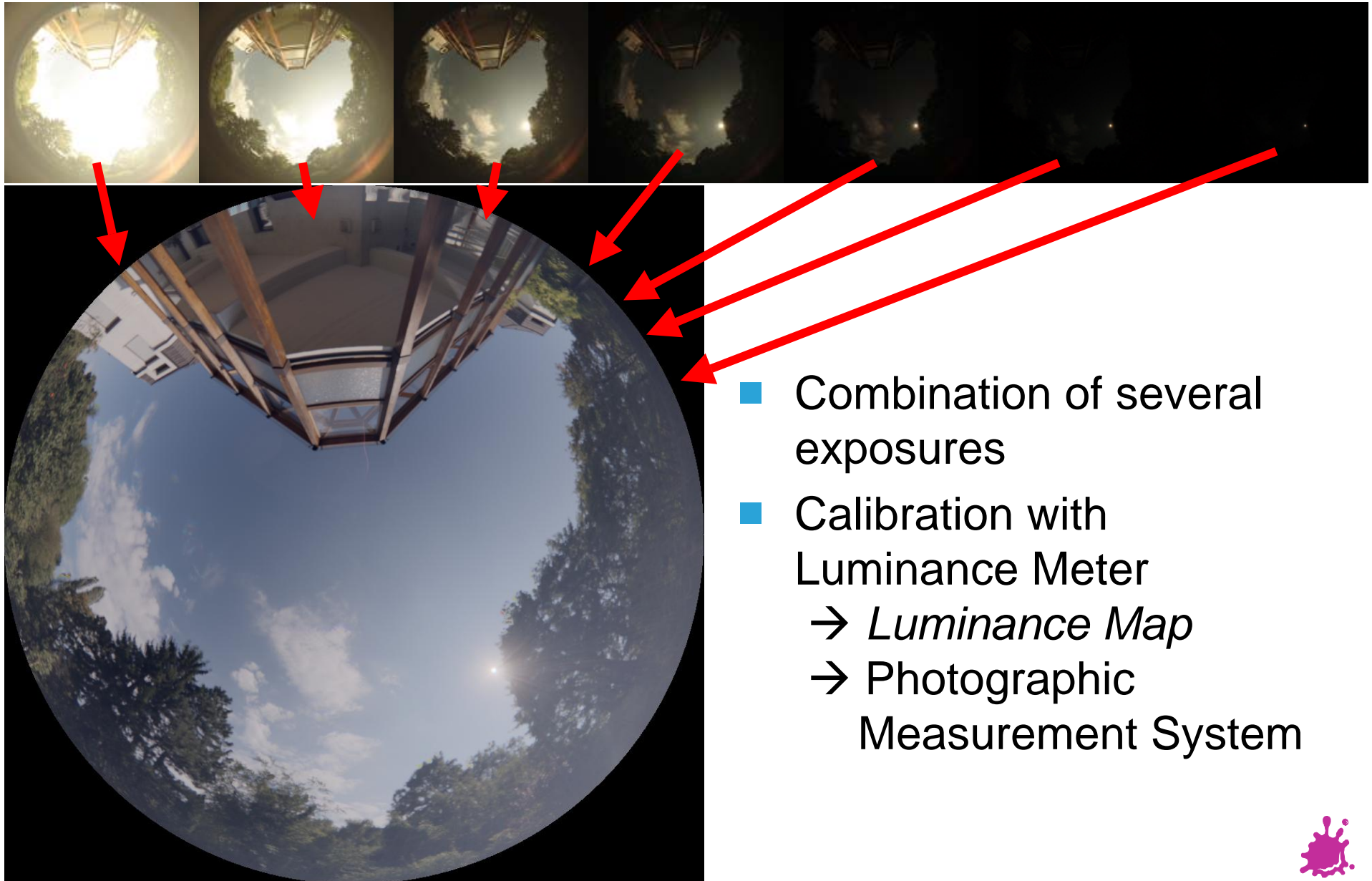
Sky Luminance and Stellar Visibility



[after Weaver 1947, Garstang 1986, Cinzano 1997]



High Dynamic Range Photography



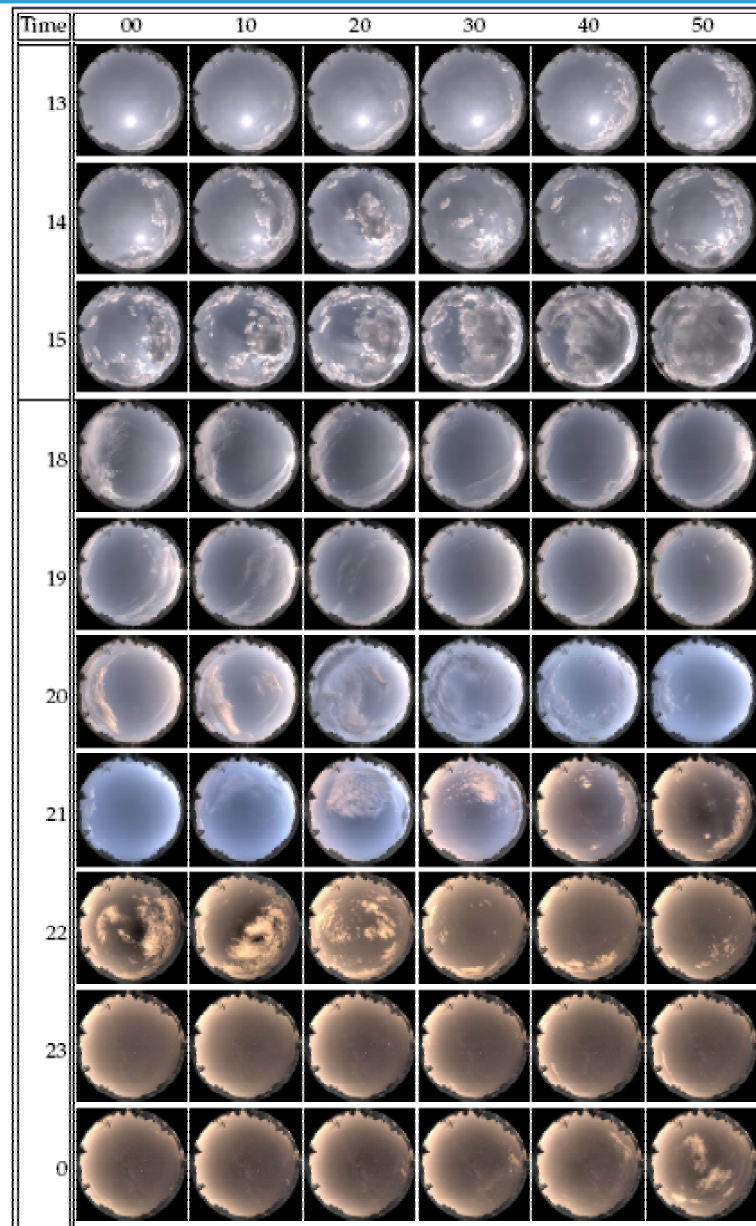
- Combination of several exposures
- Calibration with Luminance Meter
 - *Luminance Map*
 - Photographic Measurement System



- Camera: Digital SLR
 - ◆ All-Sky Fisheye only with *Full-Size Chip* DSLRs
 - ◆ RAW image format!
- Free Software:
 - ◆ **Dcraw** for RAW image processing
<http://cybercom.net/~dcoffin/dcraw/>
 - ◆ **PFS Tools** for HDR processing
<http://www.mpi-inf.mpg.de/resources/pfstools/>
 - Extensible
- Calibration:
 - ◆ PFS Tools, from EXIF data (approximative)
 - ◆ Minolta LS-110 for daylight range
 - ◆ Sky Quality Meter for night measurements



Evaluation of Zenith Luminance

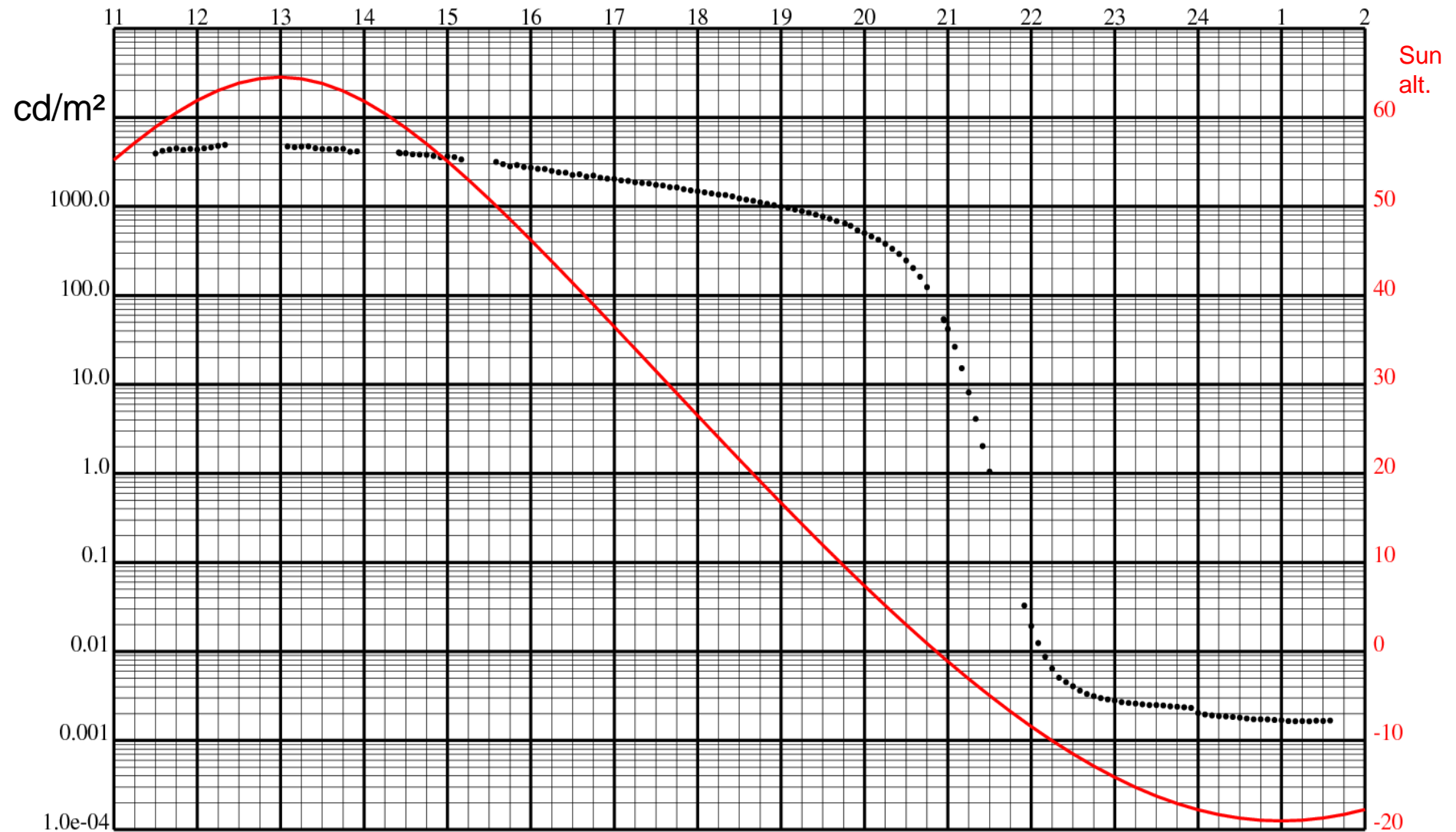


- Series of HDR photos
- Averaged zenith area

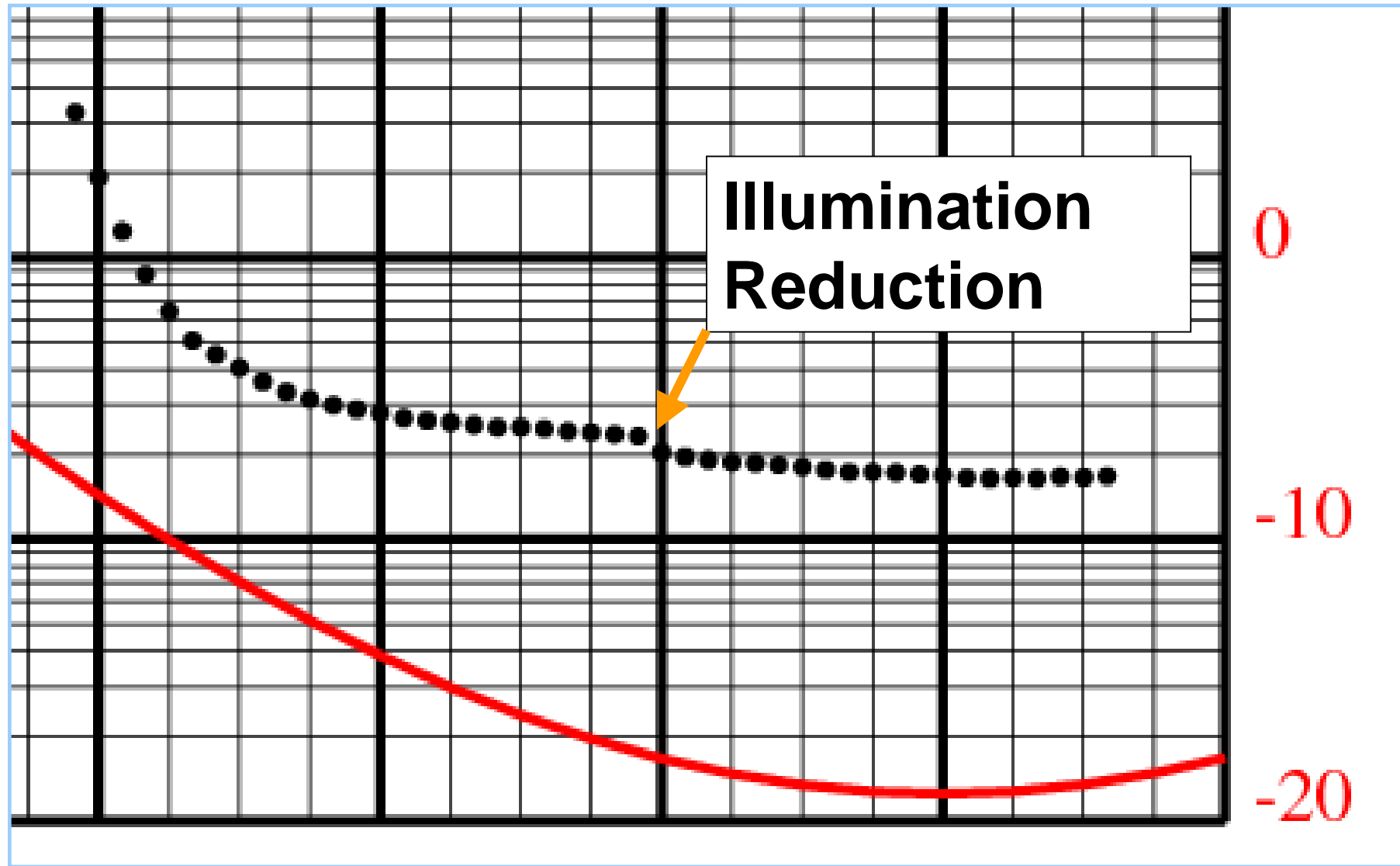
← Tonemapped
HDR images



Evaluation of Zenith Luminance



Evaluation of Zenith Luminance



Results: Suburb Sky

Full illumination

Reduced illumination



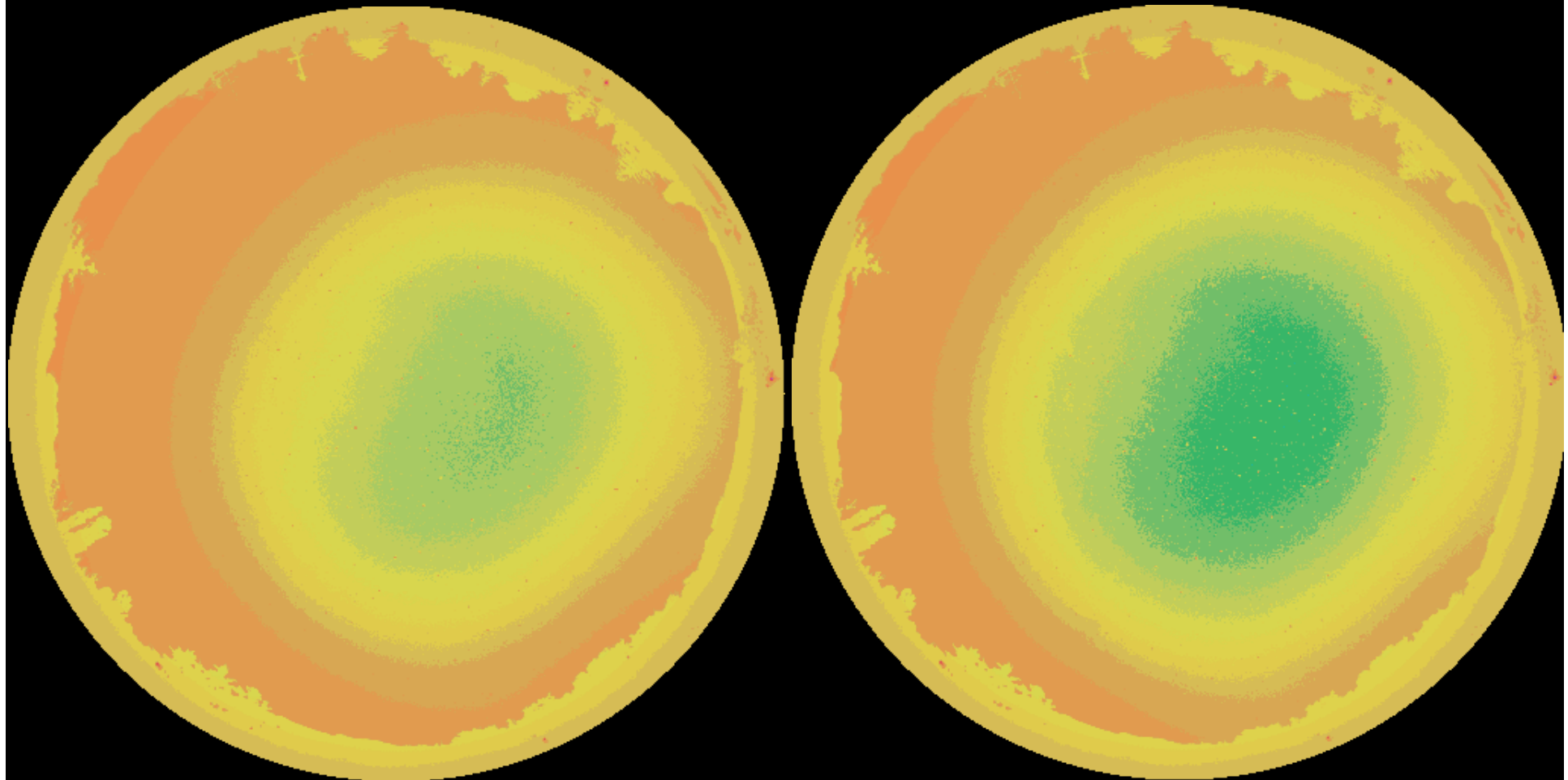
Difference on photographs hard to detect



Results: Surburb Sky

Full illumination

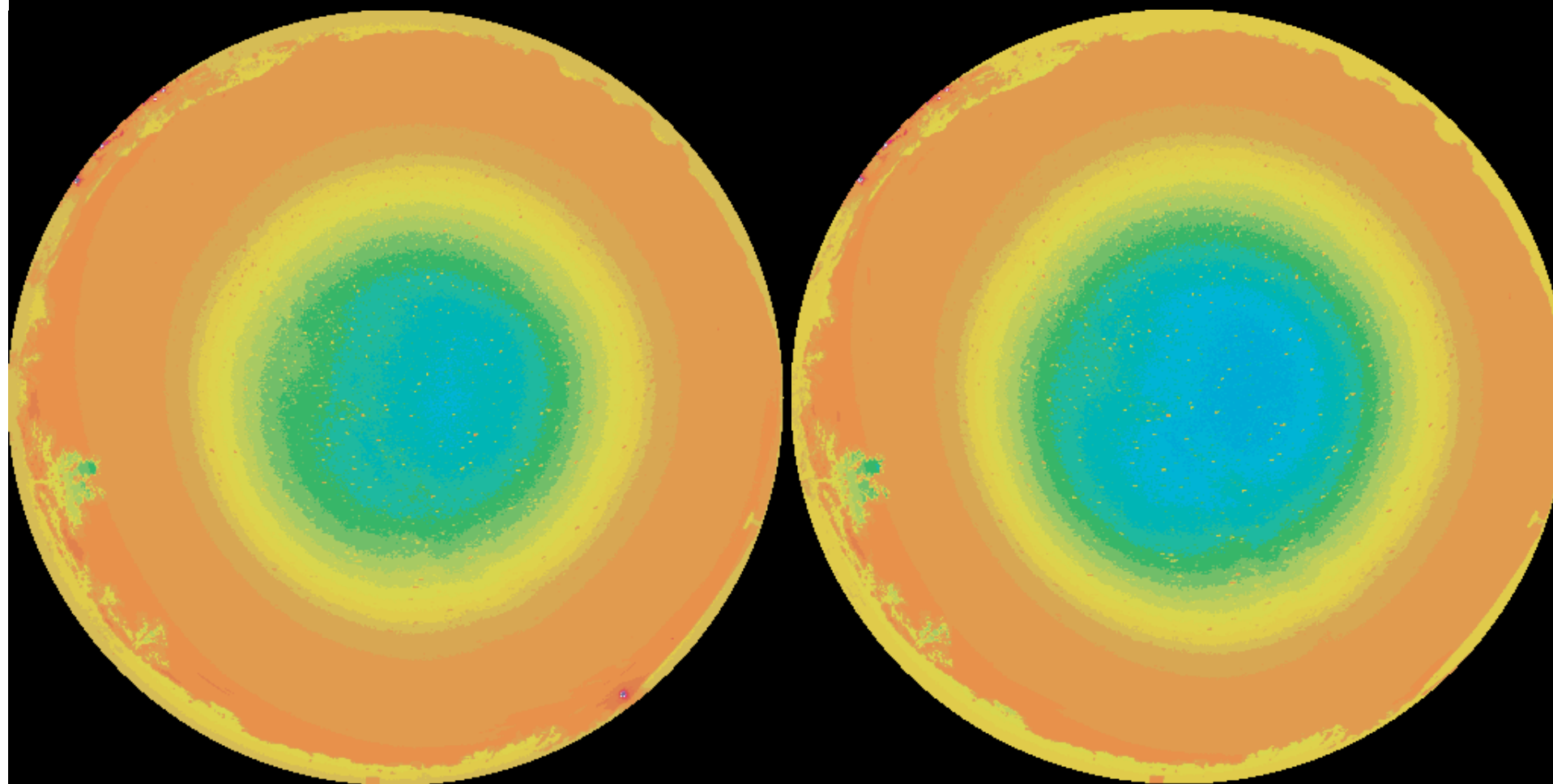
Reduced illumination



Results: City Border (average)

Full illumination

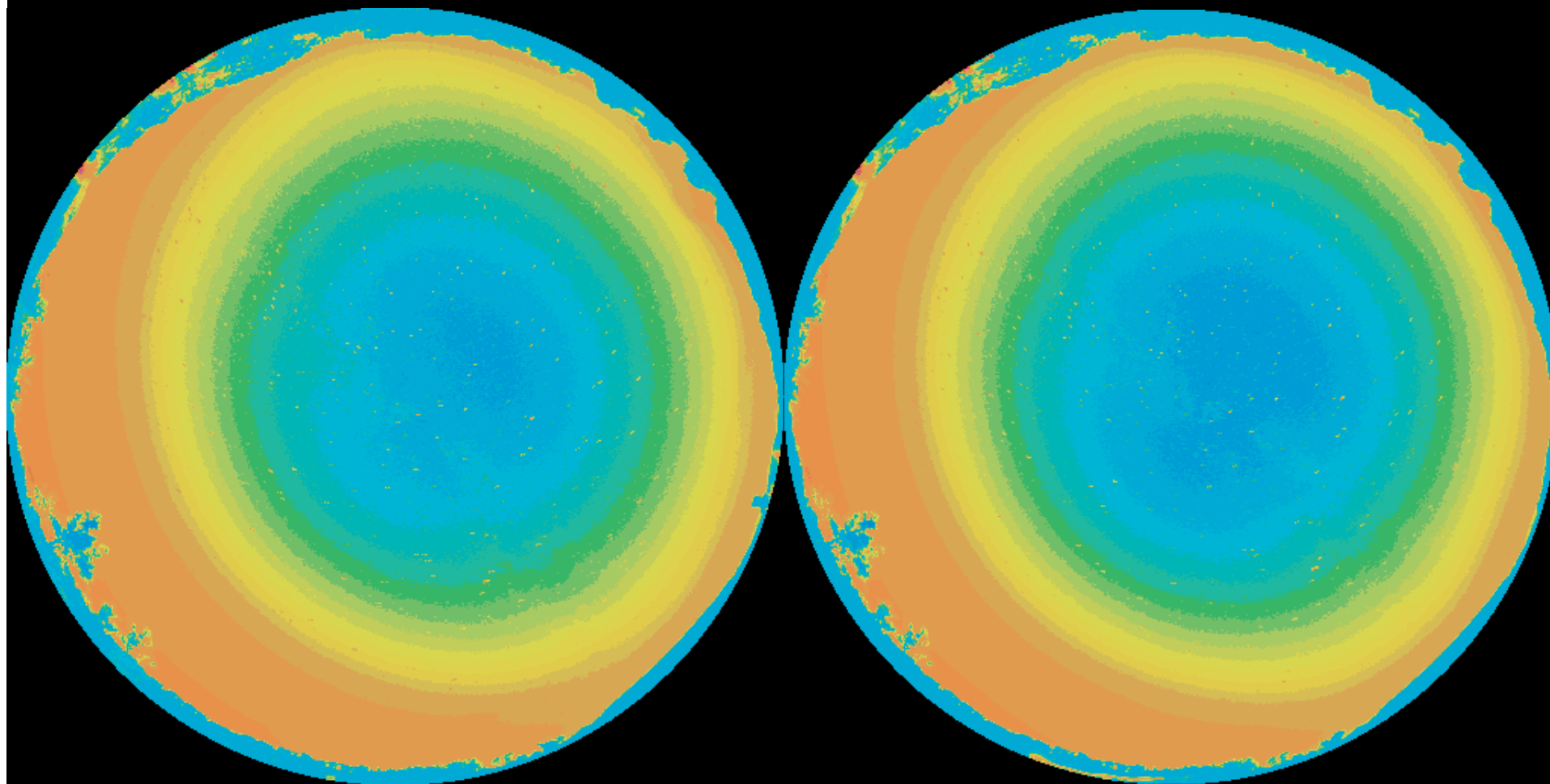
Reduced illumination



Results: City Border (good night)

Full illumination

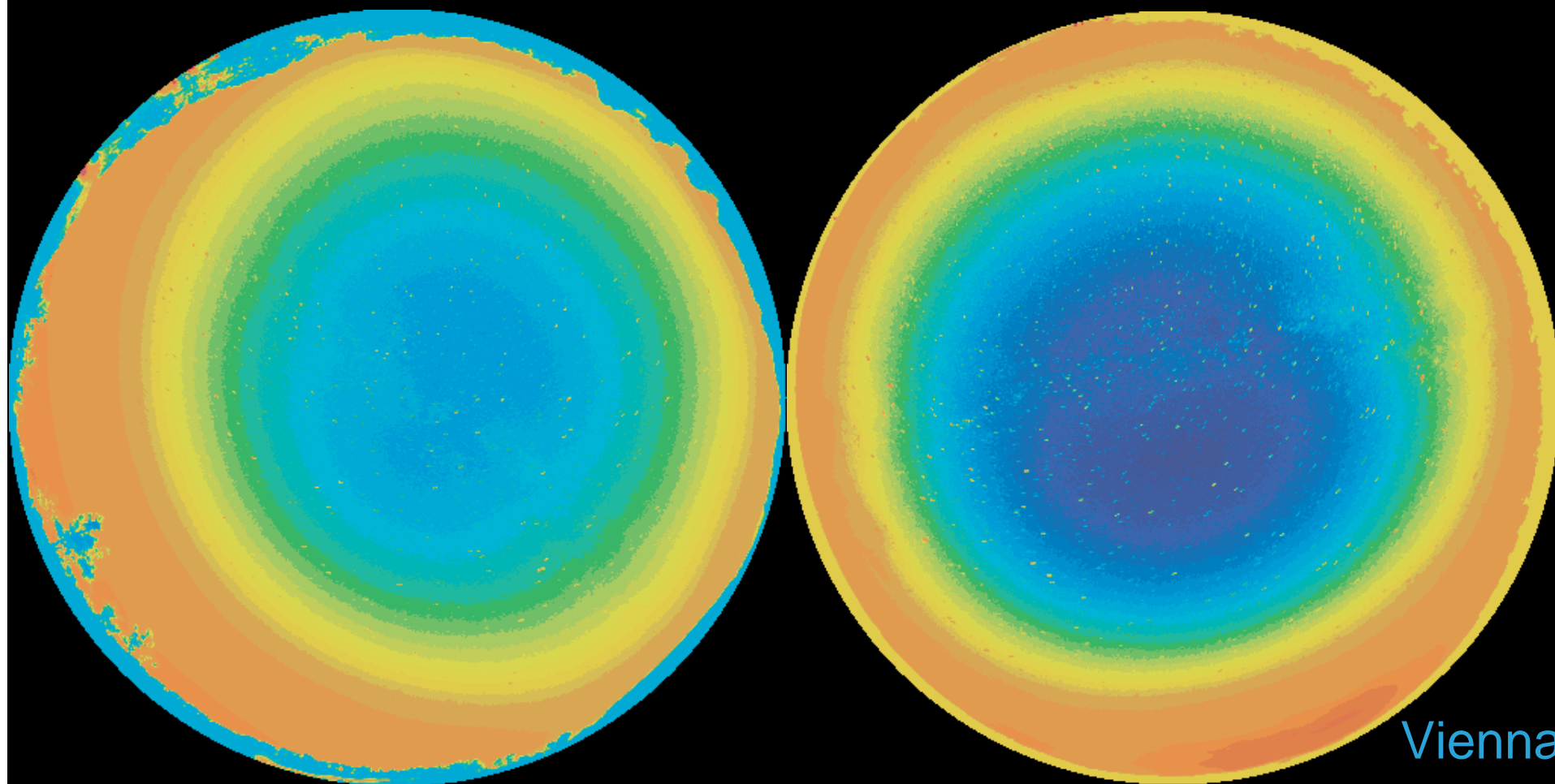
Reduced illumination



Results: City Border / 20km from Vienna

mag5

Good site near Vienna, *mag6*



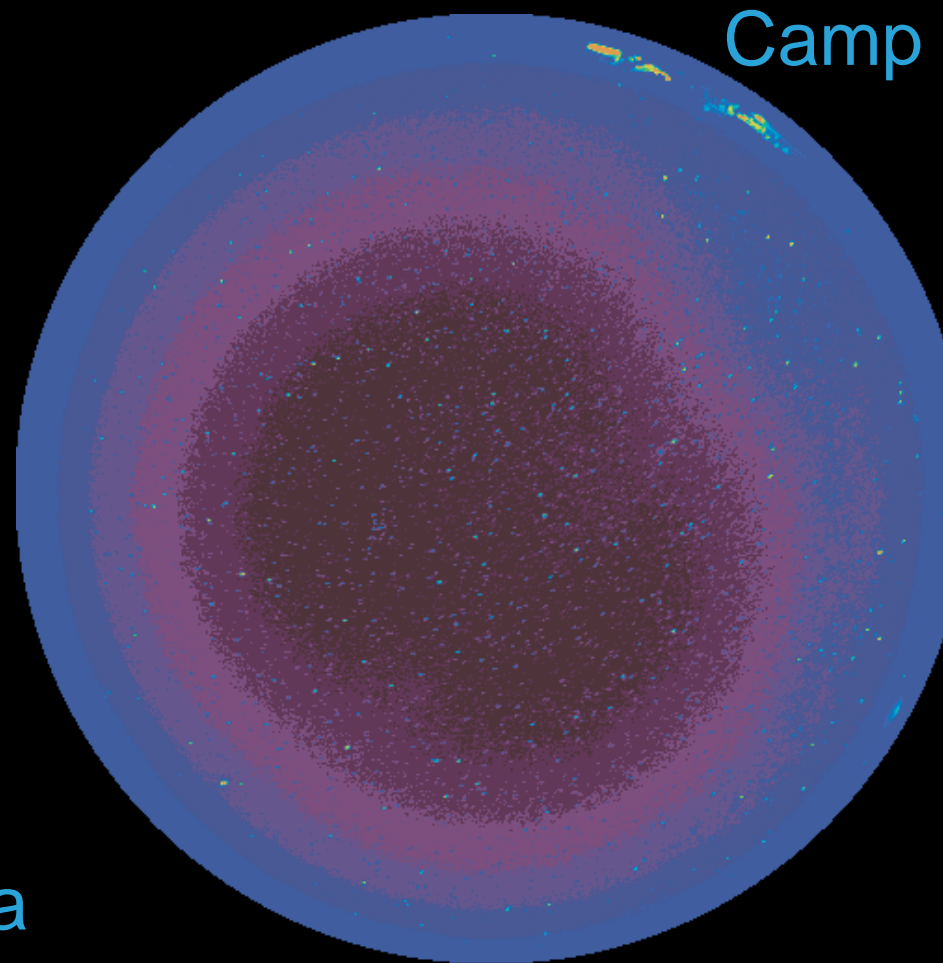
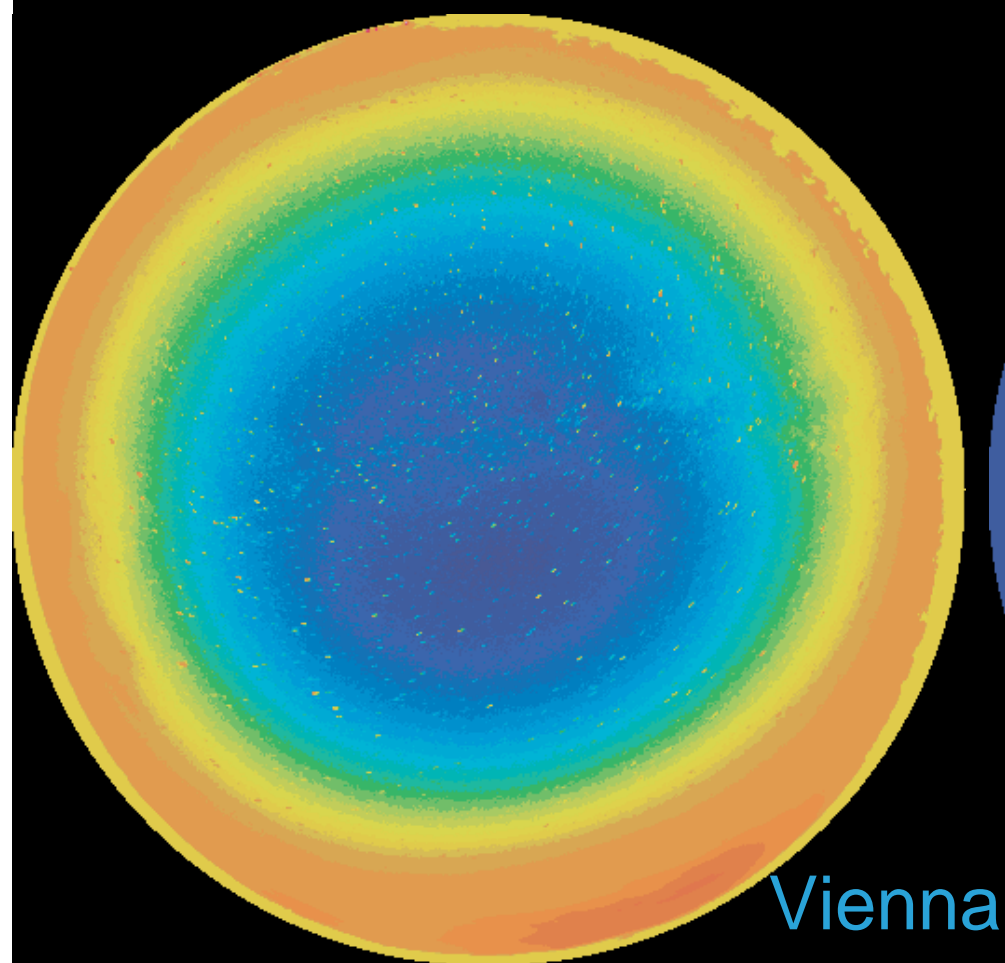
Vienna



Results: 20km from Vienna / Desert

Good site near Vienna, *mag6*

Desert Sky (Libya) *mag6.5*



- All-Sky Luminance Measurement System
 - ◆ Calibrated HDR Imaging System
 - ◆ Simple extensions to PFS Tools
 - ◆ → False-Colour Plots
 - For technical astronomers: mag/arcsec²
 - For visual star watching:
limiting visual magnitudes
 - ◆ Street light reduction clearly visible

Thank you for Your Attention
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