Light Pollution in the Near Infrared

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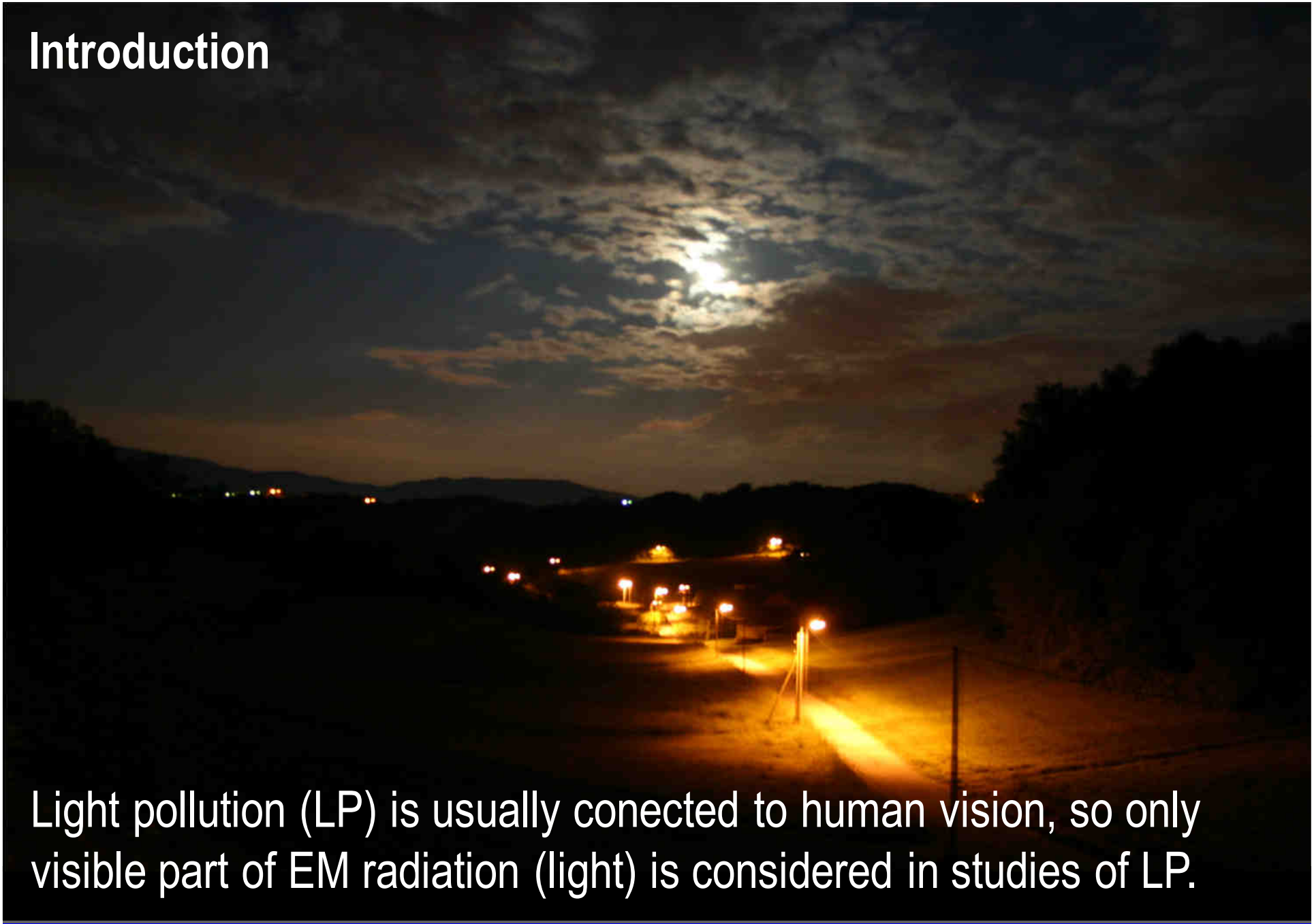
Overview

1. Introduction
2. CCD and C-MOS cameras
3. visible and infrared sky
4. past and future
5. conclusions

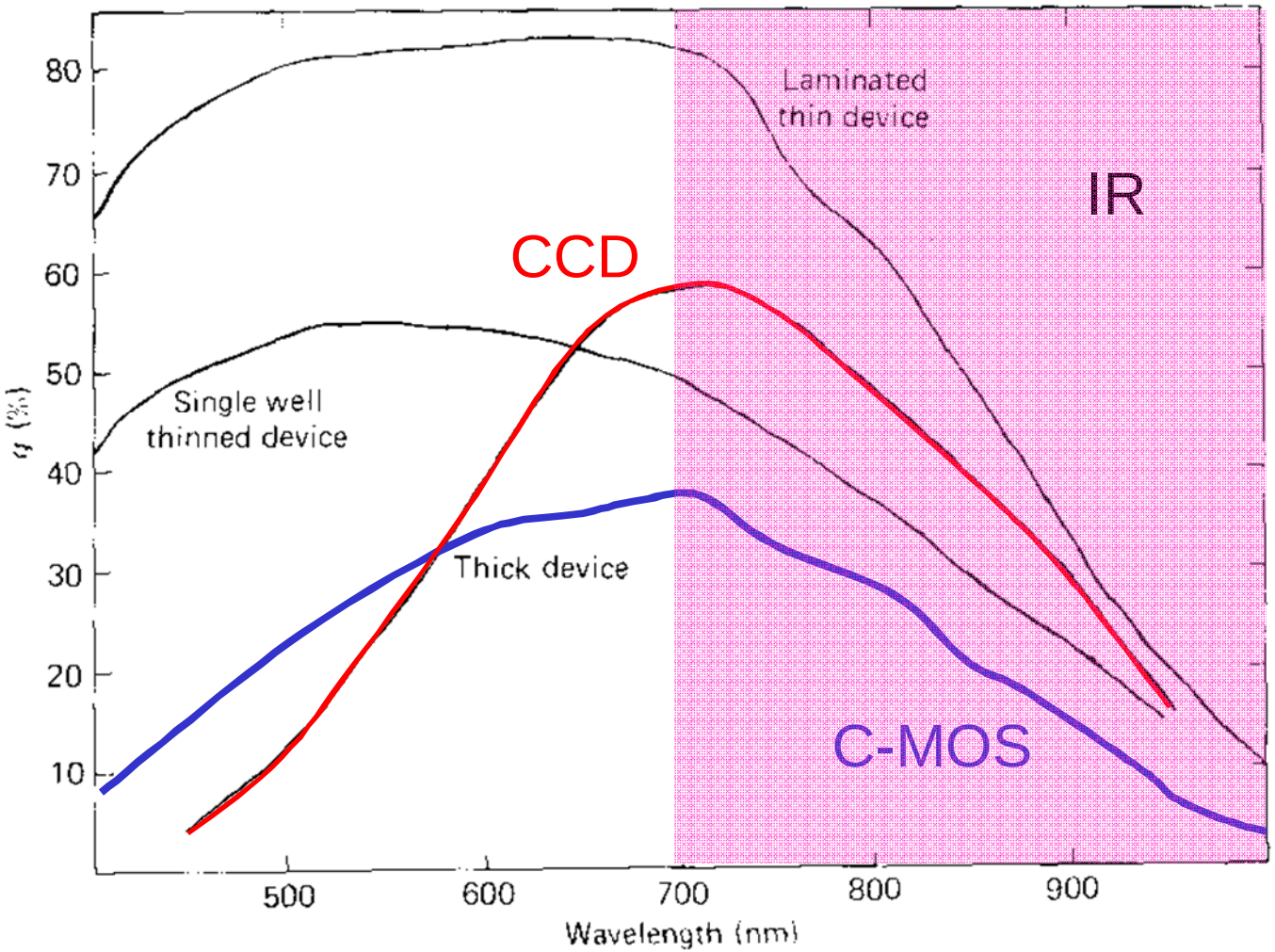
Introduction



Light pollution (LP) is usually conected to human vision, so only visible part of EM radiation (light) is considered in studies of LP.

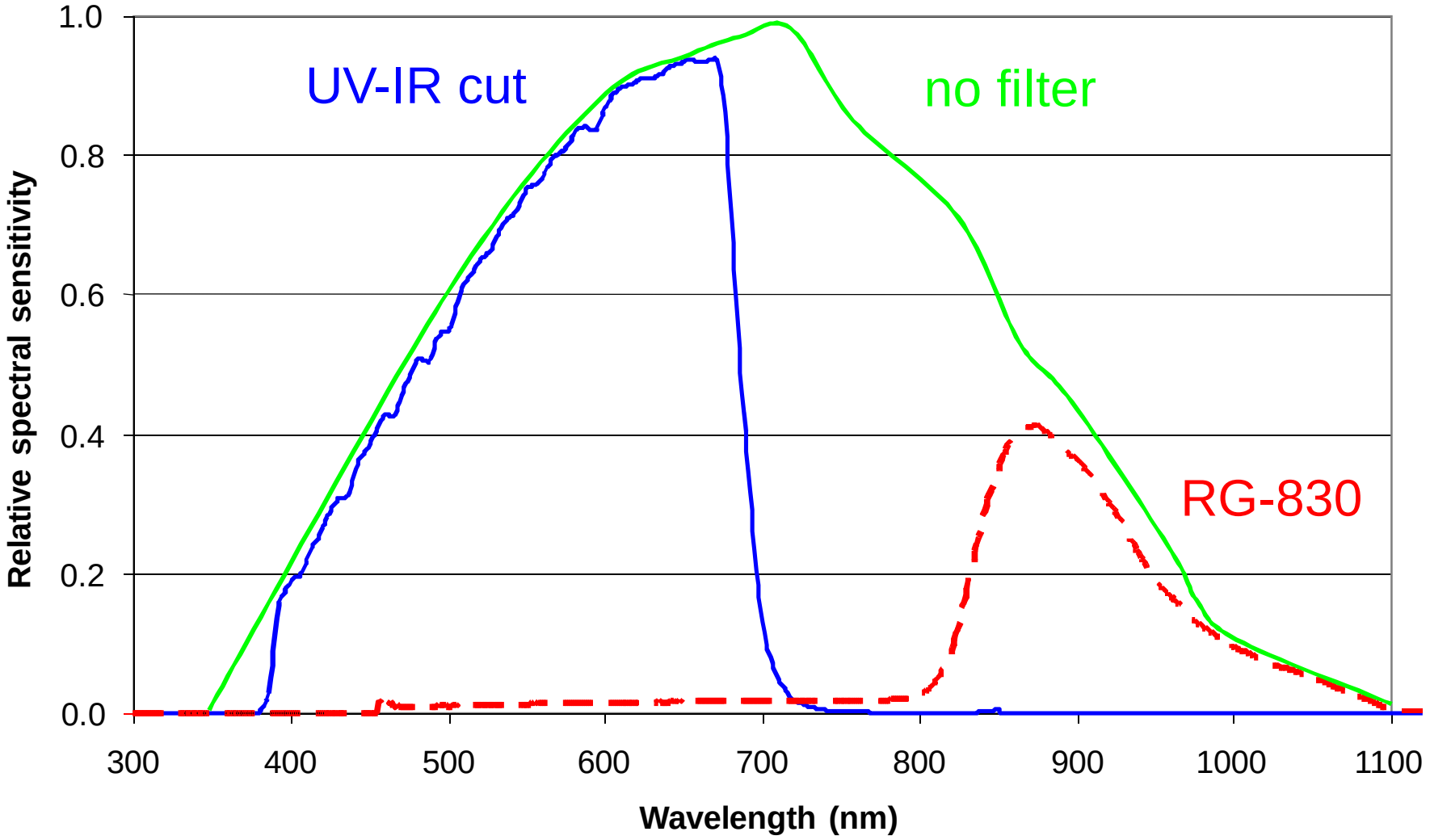
CCD cameras are sensitive to infra-red (IR) up to 1000 nm!

Fig. 8.28 Spectral sensitivity curves for various thinned and unthinned CCDs.



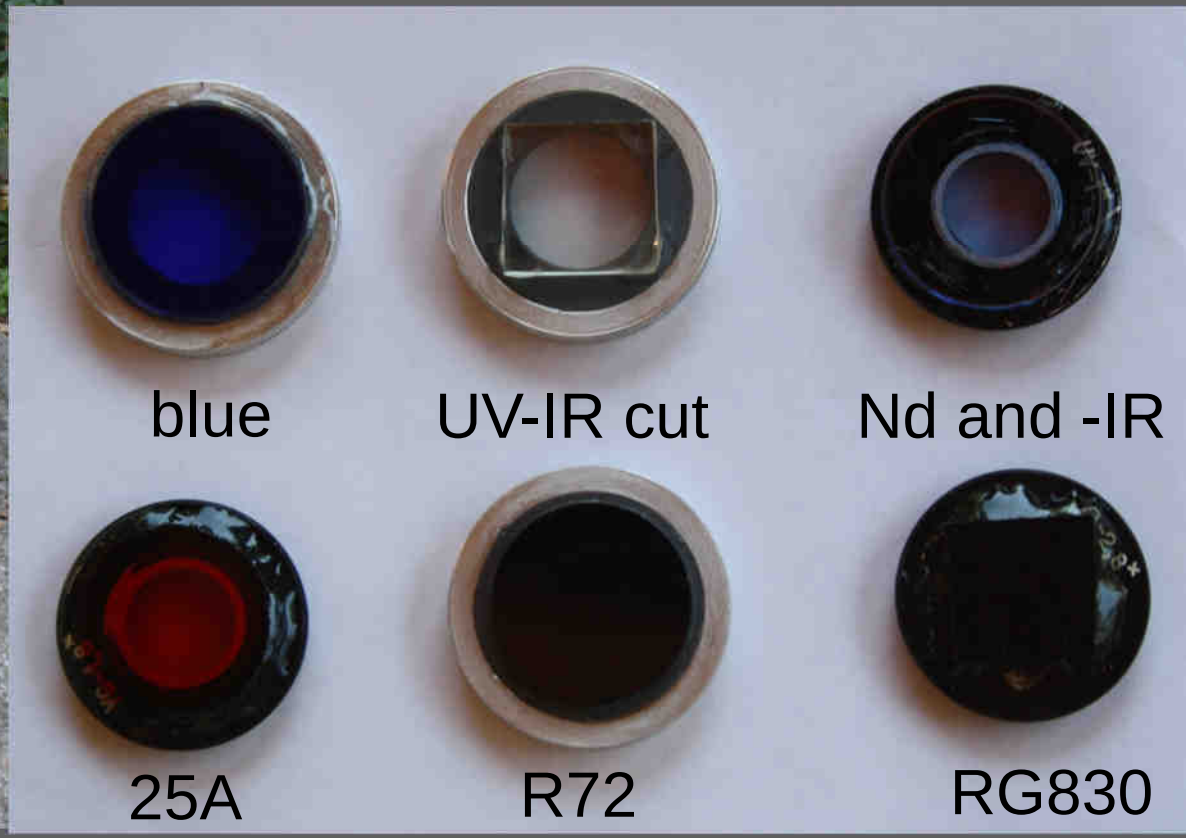
and there is "LP" in this spectral region too!

Modified DSLR camera with filters

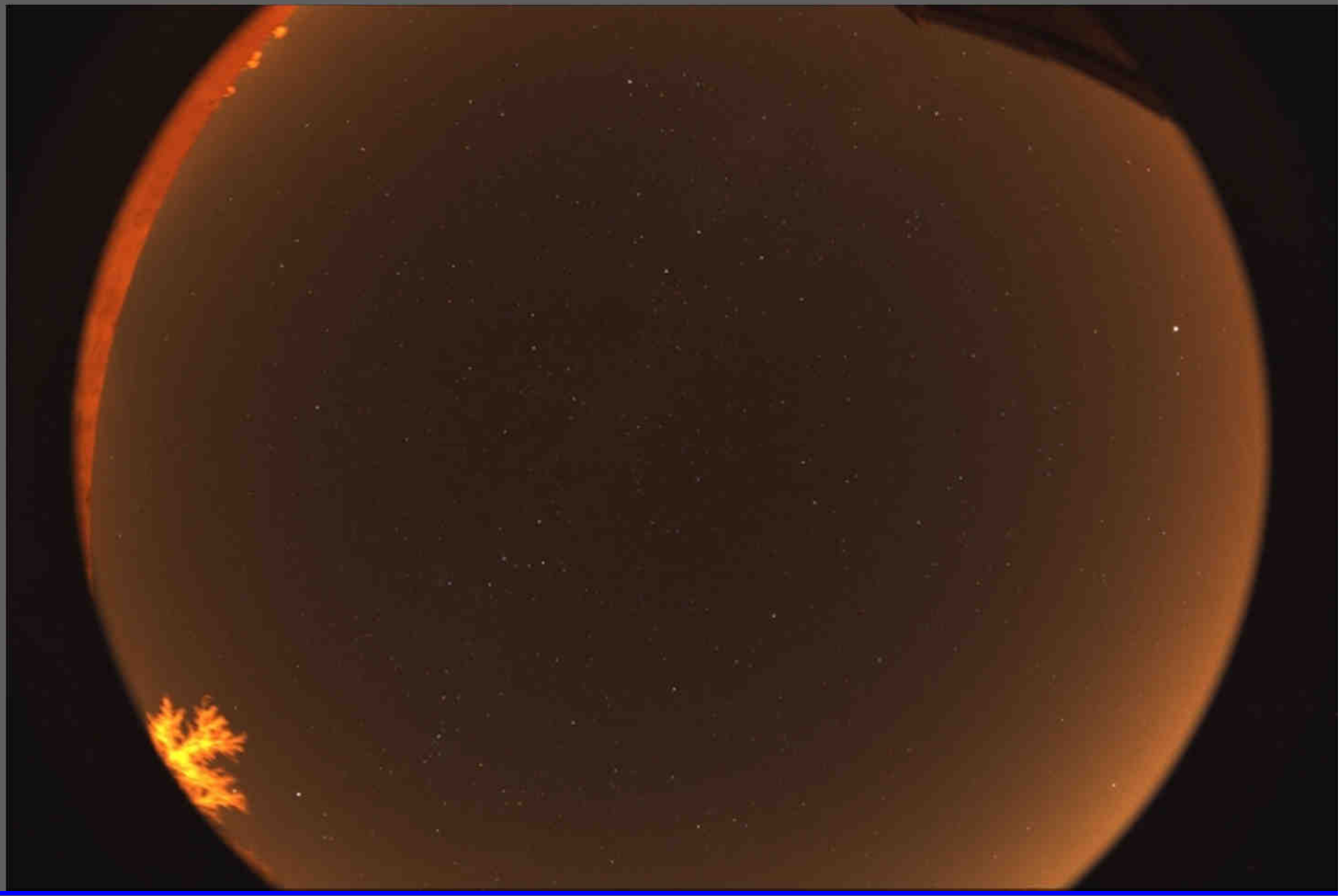


Monitoring methods: modified DSLR + fish-eye lens + filter

Light sources at the horizon can be hiden by a circular lens hood covering horizon up to 10^{o} altitude.



semi-rural sky, SQM-L: 20.2 at zenith, UV-IR cut

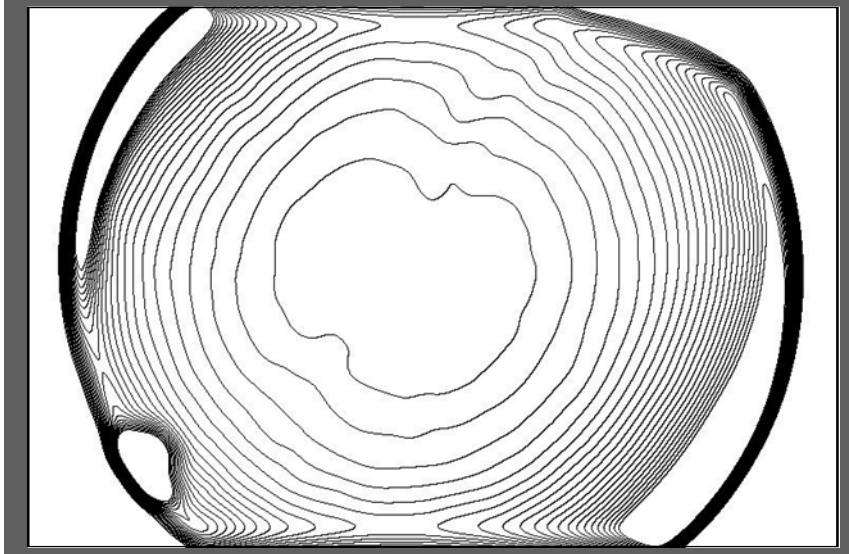


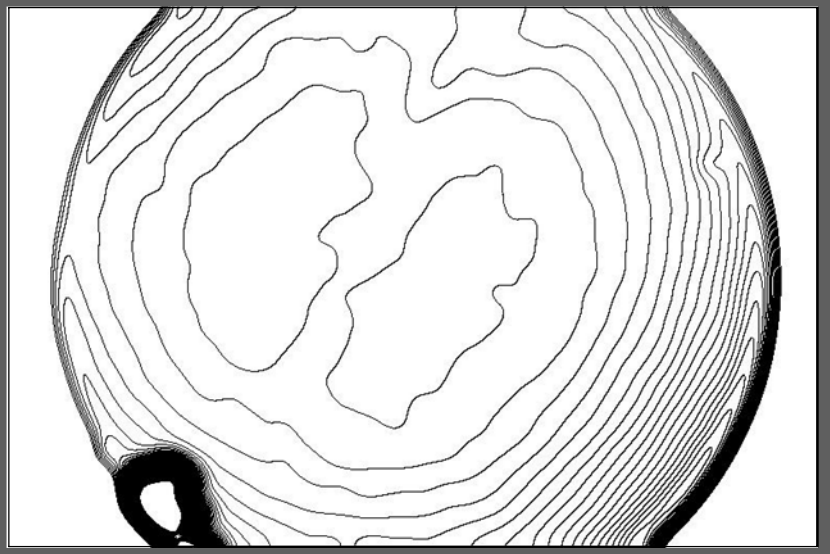
same sky, RG830 (IR)

Results

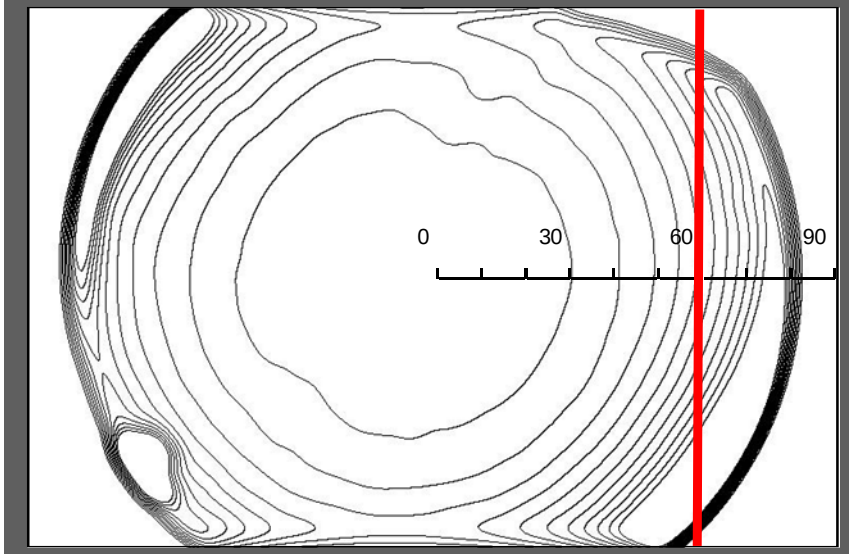
Visible

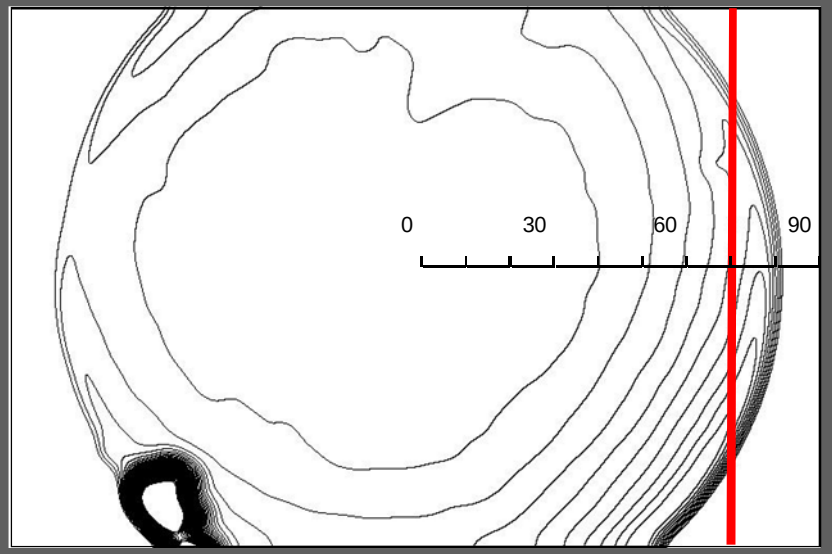
Infrared





iso-phote each 10%



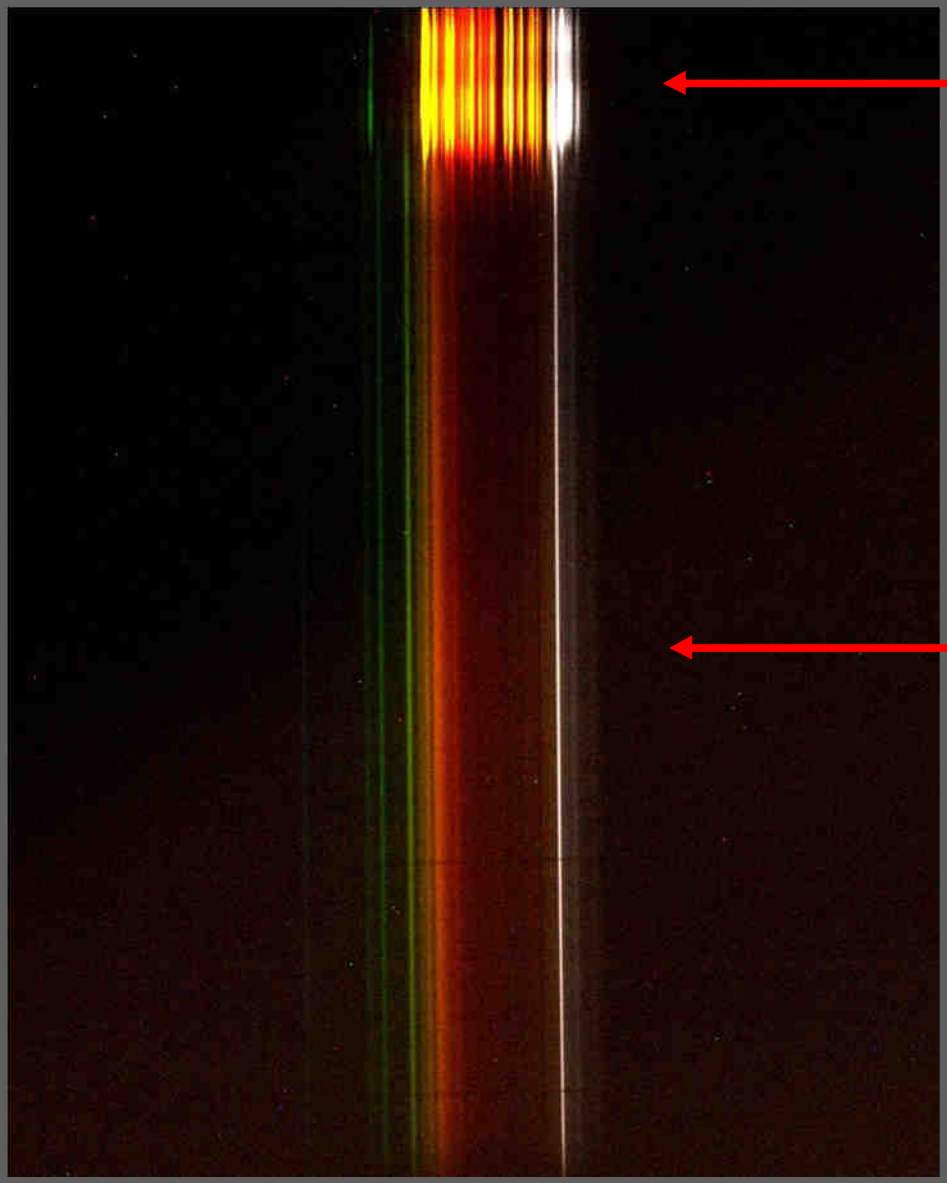


20%

Monitoring methods: modified DSLR + spectrograph

- Fast prismatic spectrograph
- covers 420-1100 nm
- wavelength calibration lamp integrated
- records natural sky spectrum in 5 min at ISO 1600 with a modified DSLR

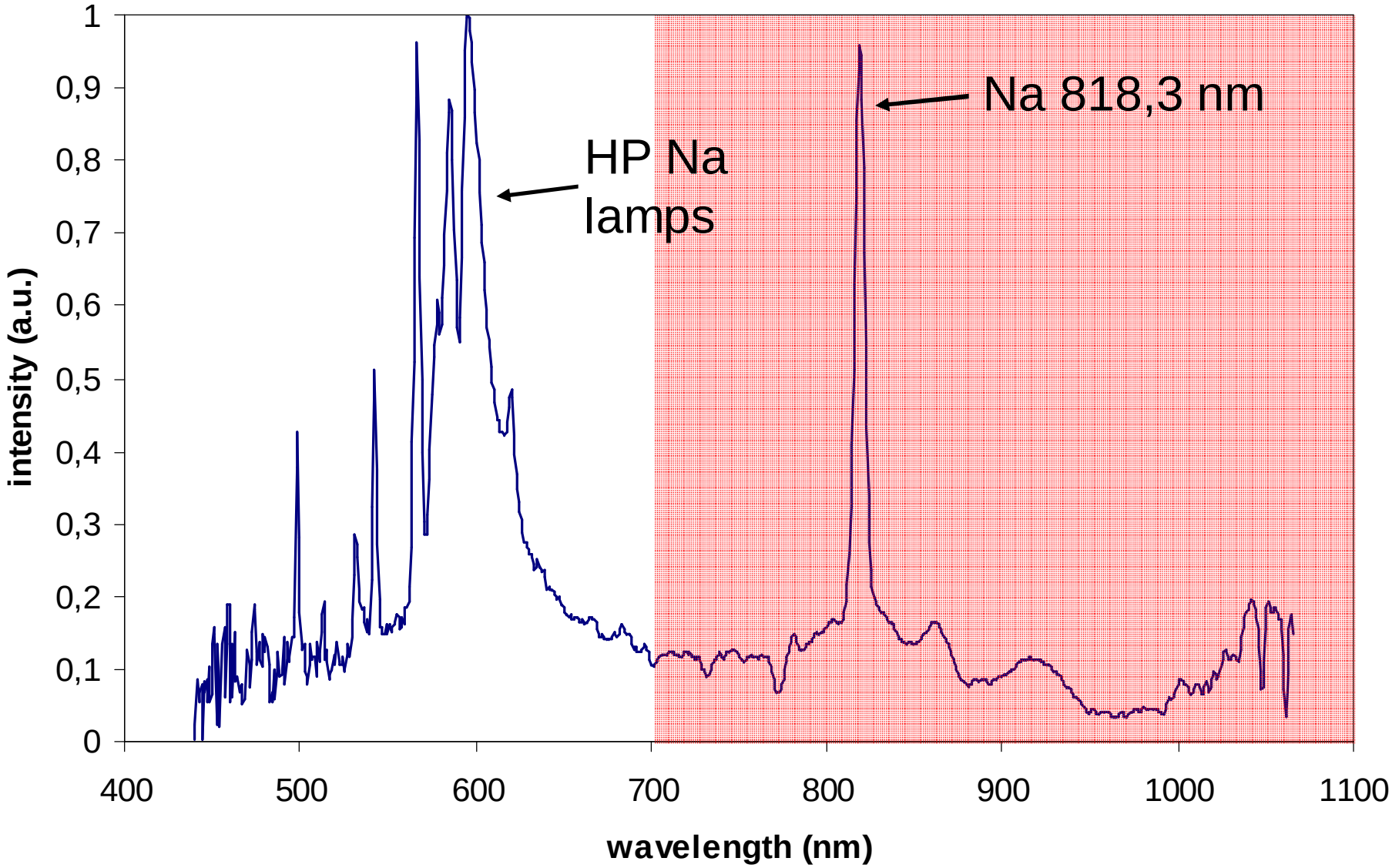
LP spectrum, same place



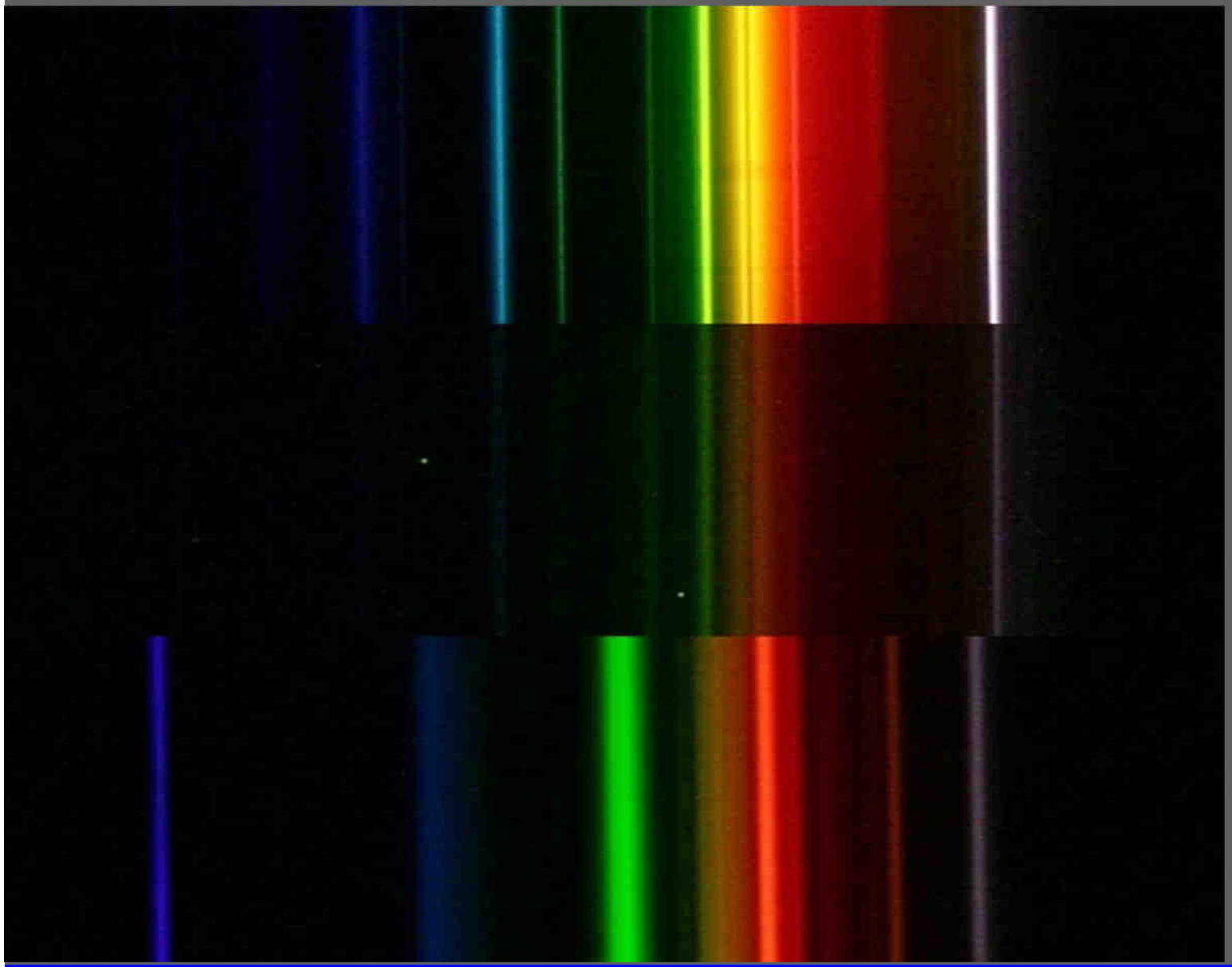
Ne comparison

Sky spectrum
around zenith

Results

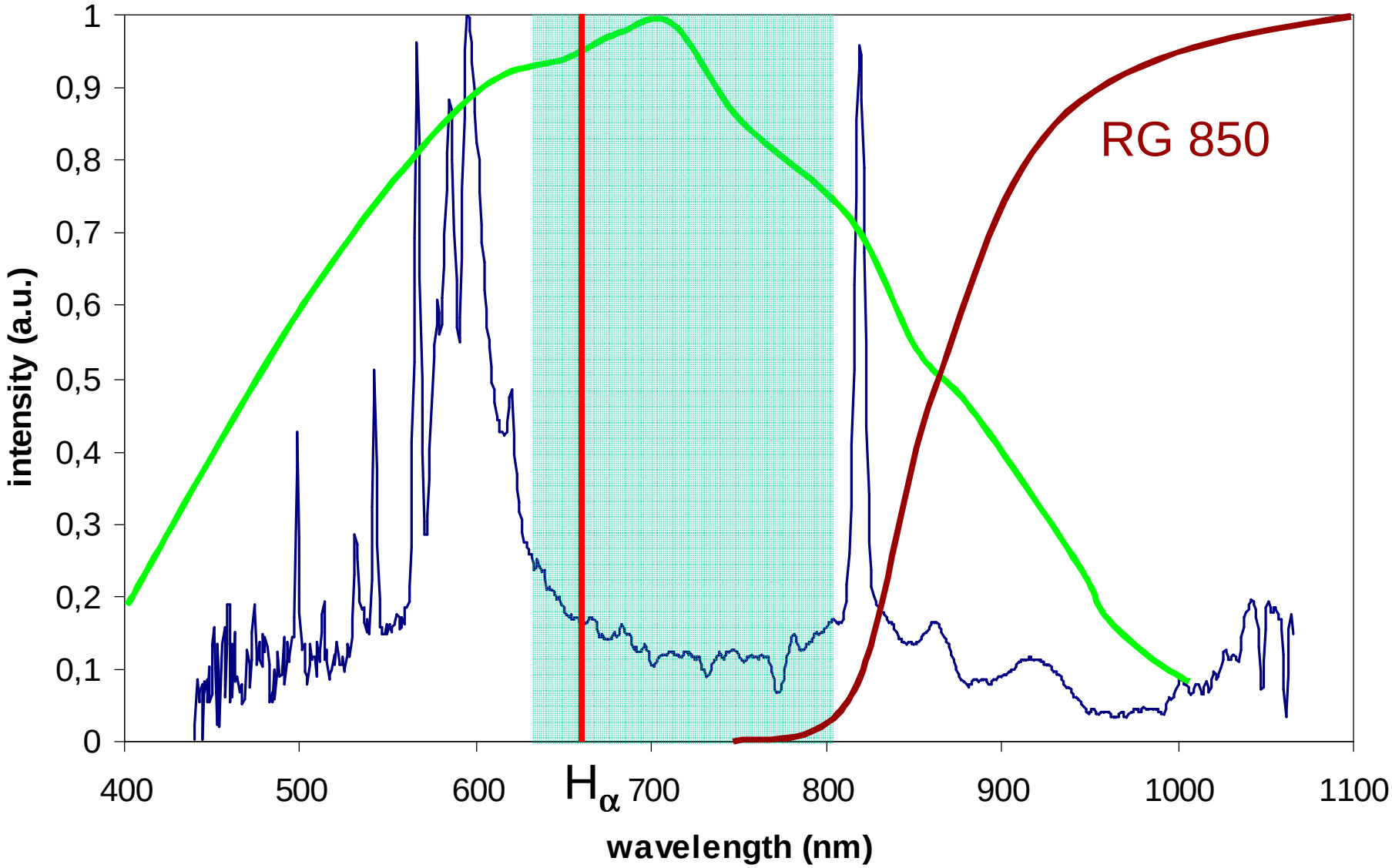

Na 818,3 nm
HP Na lamps
intensity (a.u.)
wavelength (nm)
0
0,1
0,2
0,3
0,4
0,5
0,6
0,7
0,8
0,9
1
400
500
600
700
800
900
1000
1100

HP-Na bulbs are the culprit!

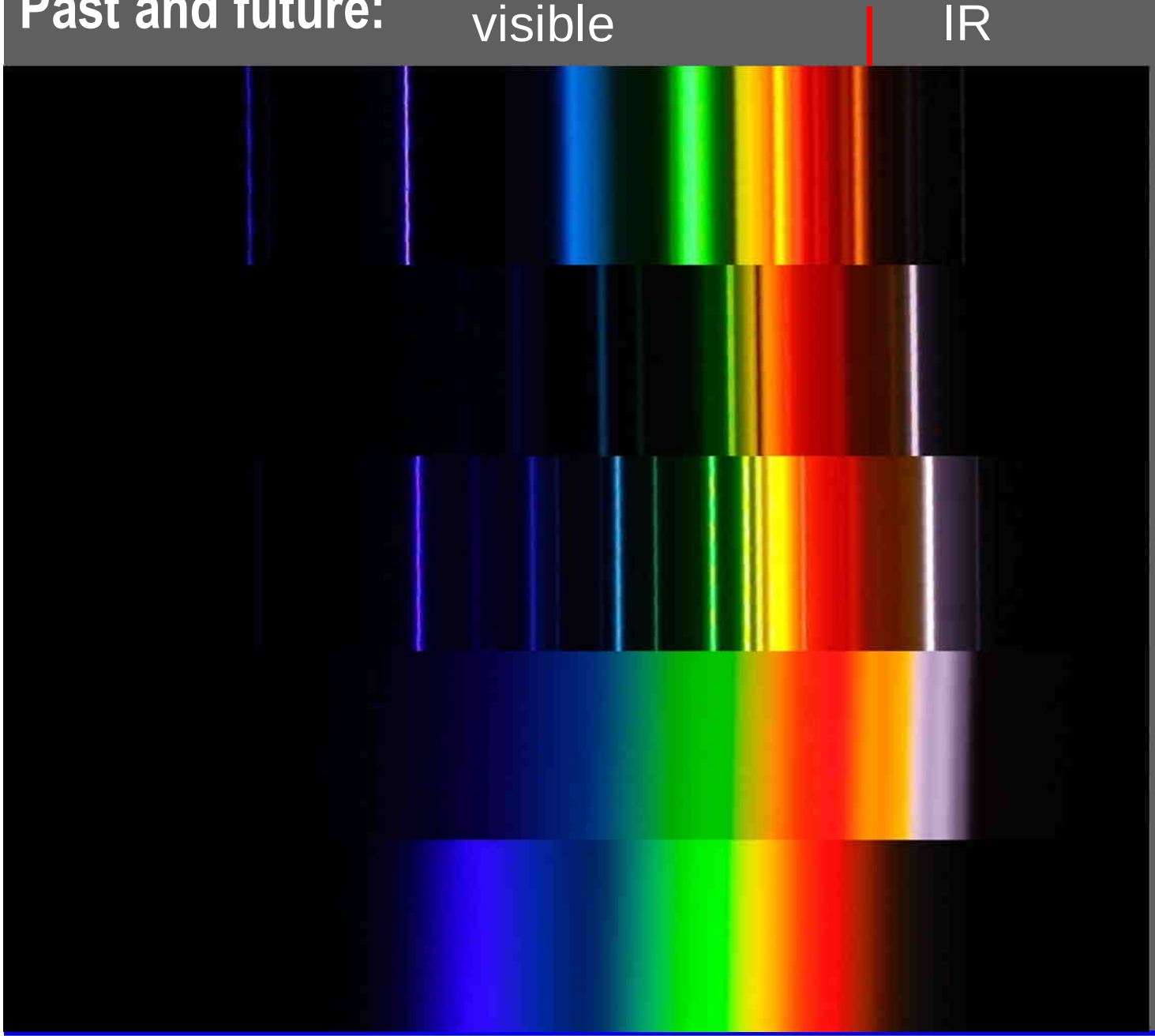


possible solutions

custom interference filter?



Past and future:



Conclusions

1. There is strong LP in the near infrared, and it is produced by the same sources responsible for the LP in the visible part of the spectrum. Sodium bulbs produce very strong IR LP.

2. IR is not as crowded with LP spectral lines as visible part of the spectrum, good filtering is still possible.

3. Scattering of the IR light is not as effective as for the visible light, so the IR sky quality is little better. Also, natural sky brightness is higher in the IR, making LP less prominent.

4. Light cirrus clouds are often prominent in the IR, but are invisible in the visible light.

Conclusions 2

5. New metal-halide (MH) lamps polute more than sodium HP lamps, both in the visible and in the IR .

6. LED sources polute only in the visible, but show a very worrysome excess of blue light, that should be filtered at the source at any cost.

Acknowledgements

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http://www.humboldt-foundation.de

Thank you for your attention!

Questions?