
Observing skyglow change via citizen science - the Loss of the Night app

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Physical changes to Earth's biosphere

- Chemical pollution
- Greenhouse gases
- Plastic
- Radioisotopes
- Land use / impermeable surfaces

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- **Artificial light at night**

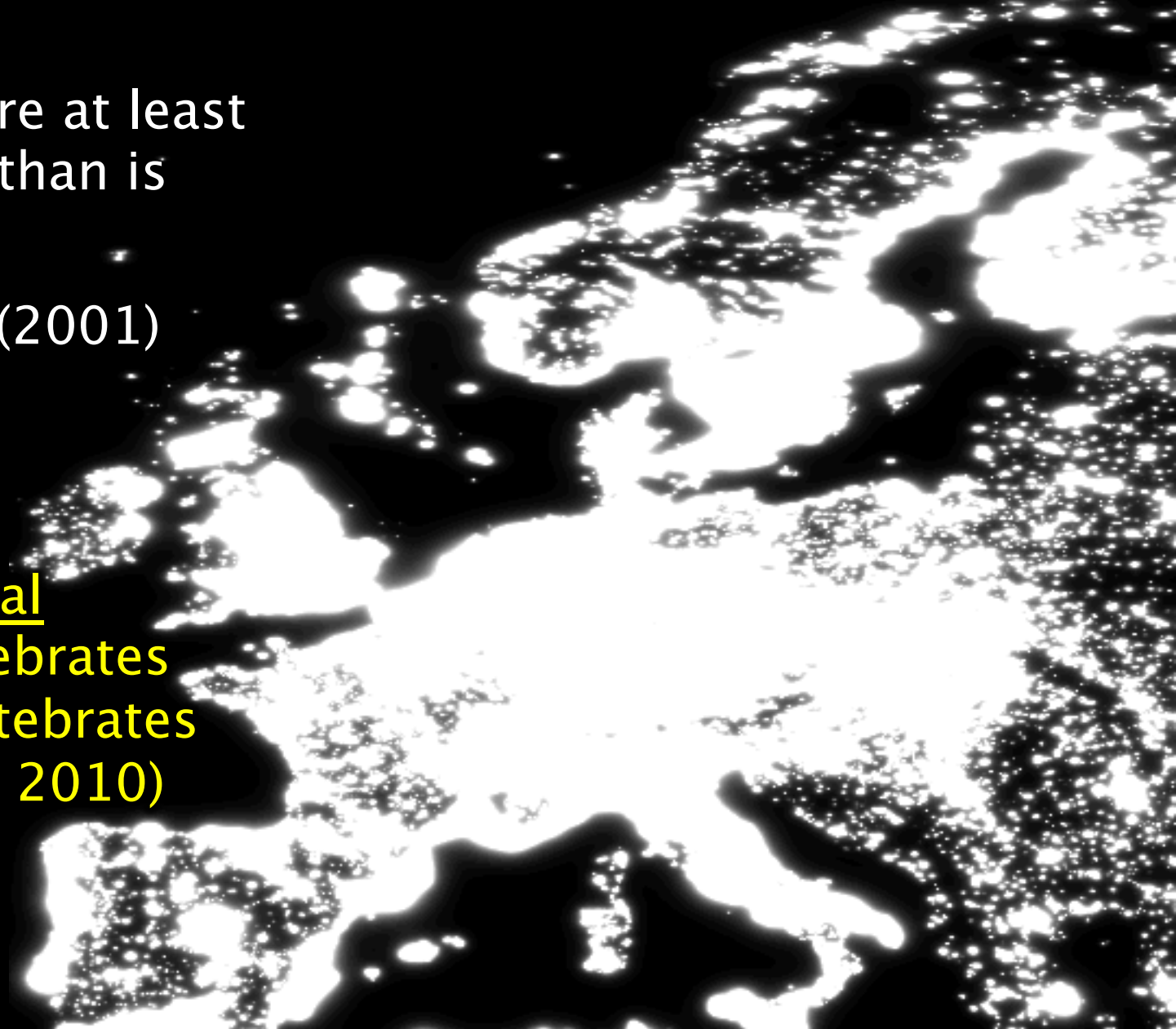
Skyglow in Europe

White areas are at least
35% brighter than is
natural

Cinzano et al (2001)

Nocturnal

~30% of vertebrates
>60% of invertebrates
(Hölker et al. 2010)



Skyglow



Photo by Jeremy Stanley, available on Wikimedia common

LEDs and satellite observations

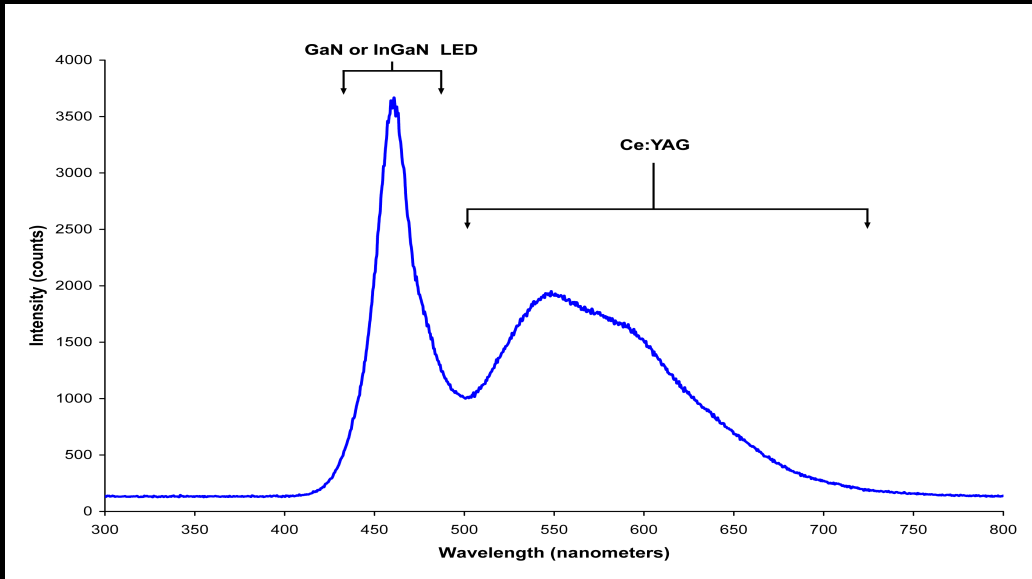
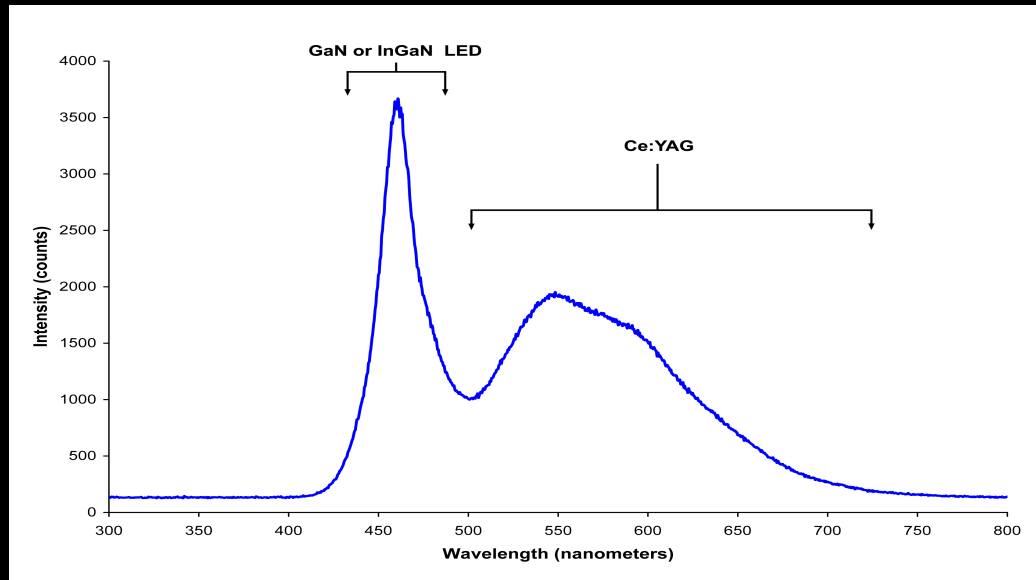


Image by Deglr6328,
Wikimedia Commons

Blue

Red

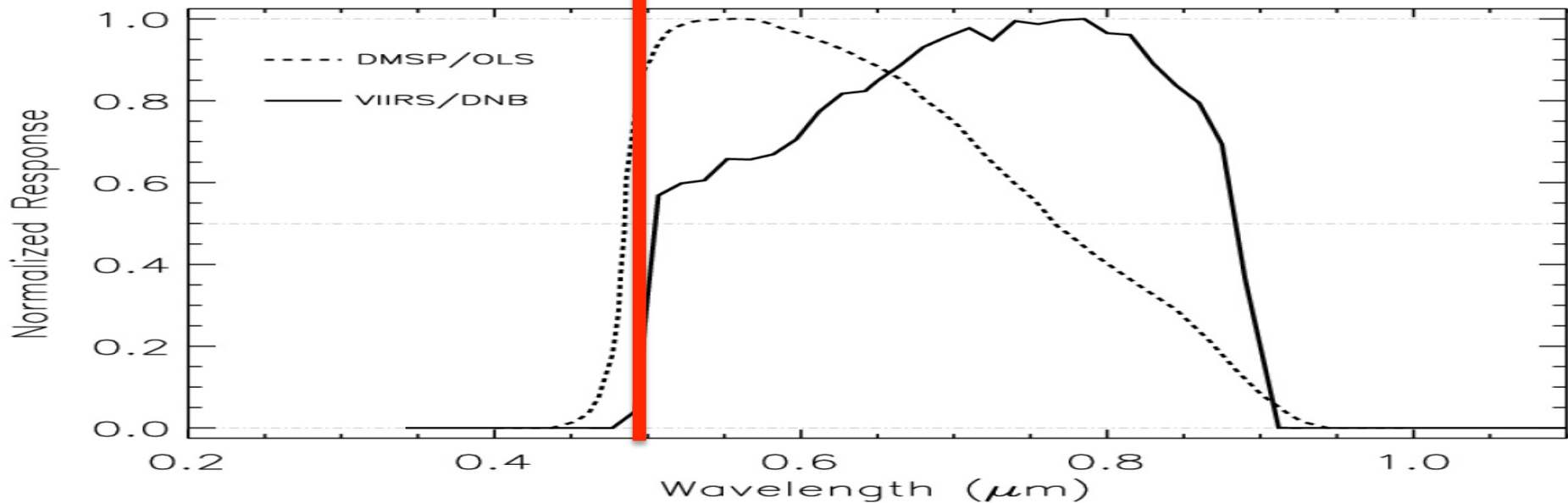
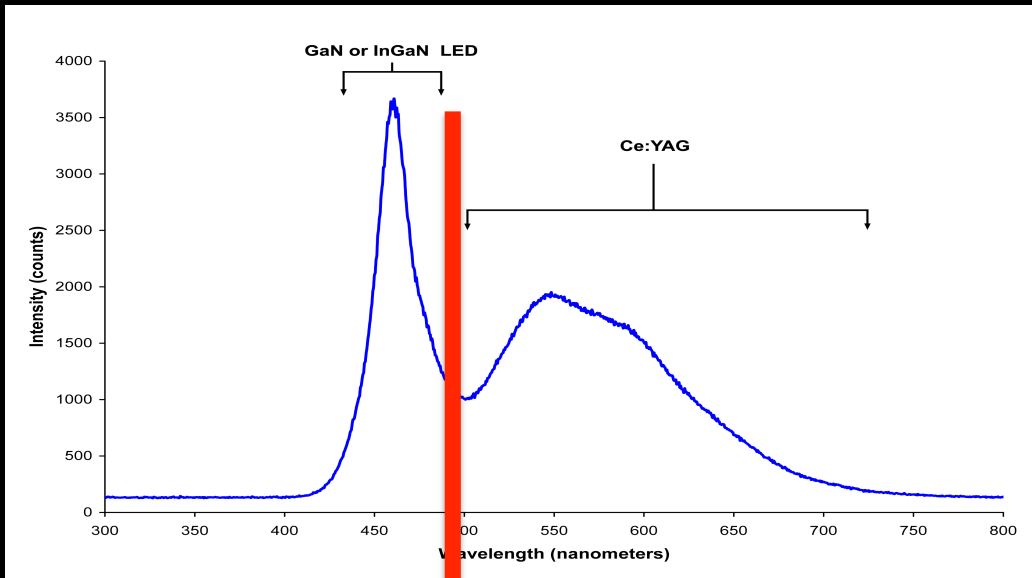
LEDs and satellite observations



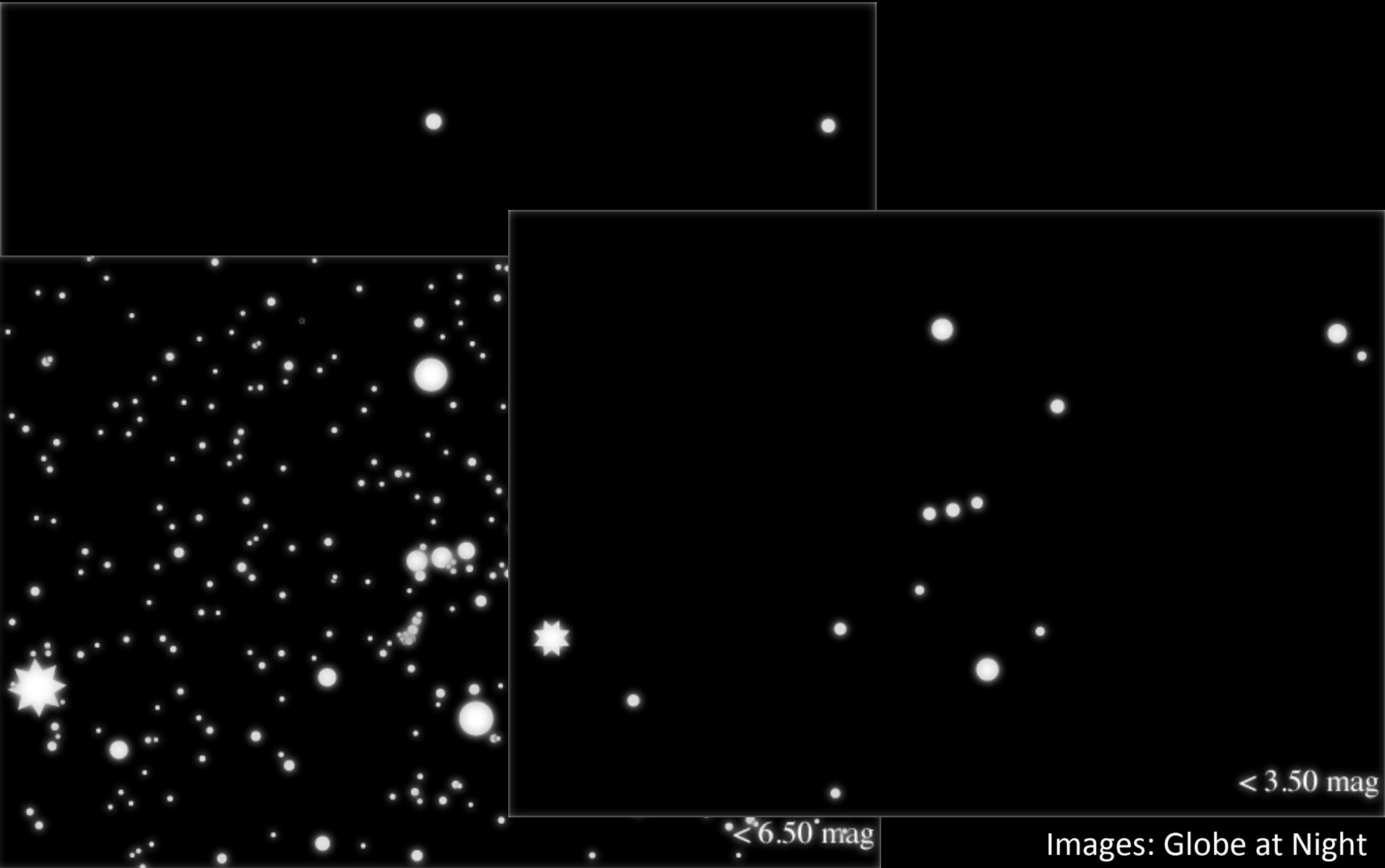
Blue **Red**

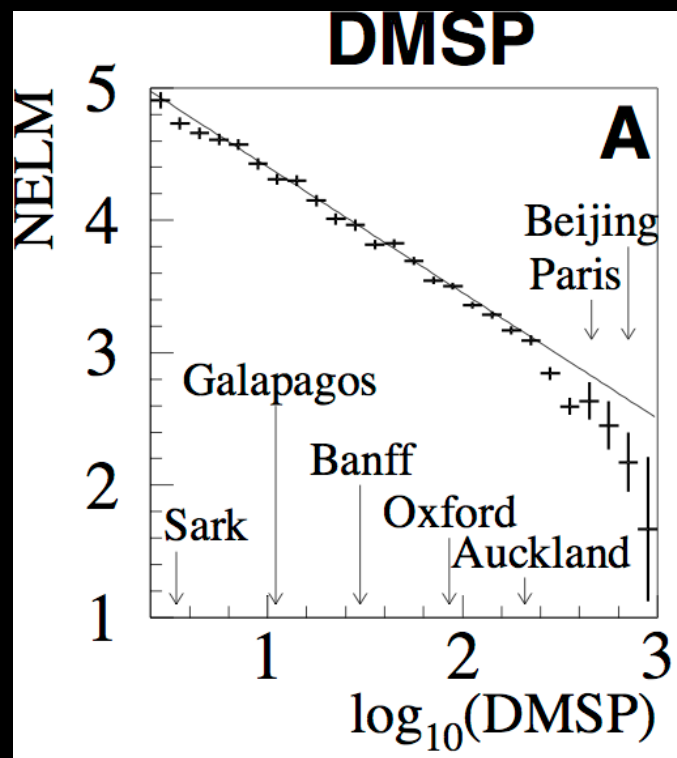
Satellite sensitivity (VIIRS DNB)

LEDs and satellite observations



Background: Globe at Night





Comparing faintest
visible star to
ground brightness
from satellite
observations

Kyba et al.
Sci Rep (2013)

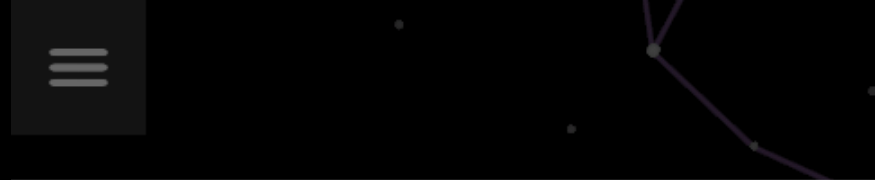
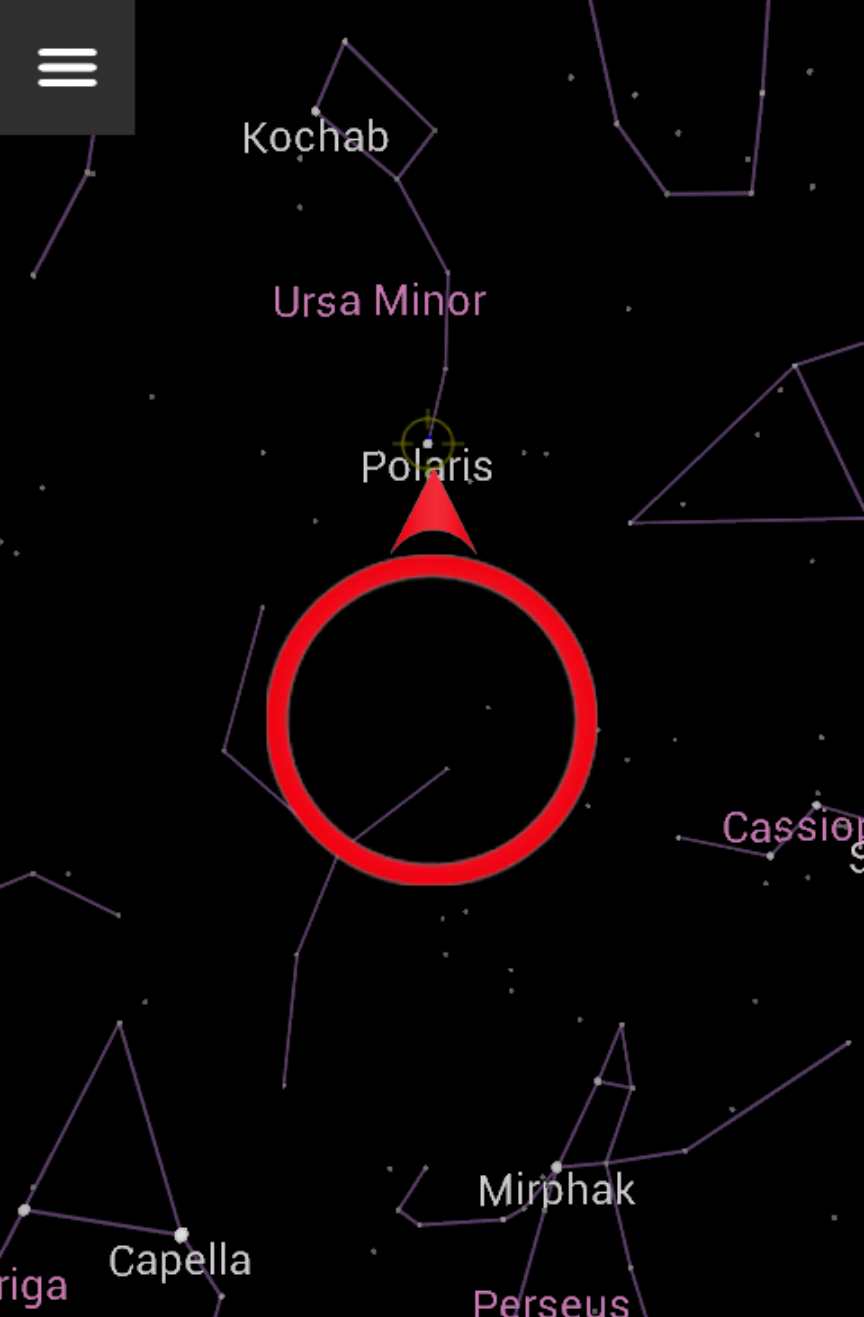
Problems with GaN

- Can't identify constellations in the city
- Δ_m is fairly large for individual observations (~ 1.2 mag)
- Airmass depends on location

LOSS
of the ✨
NIGHT

Solution: Loss of the night app!

- Based upon Google Sky program
- Users make decisions on individual stars



STAR NOT VISIBLE

You selected the option Not visible or unsure. Please tell us more about the reasons.

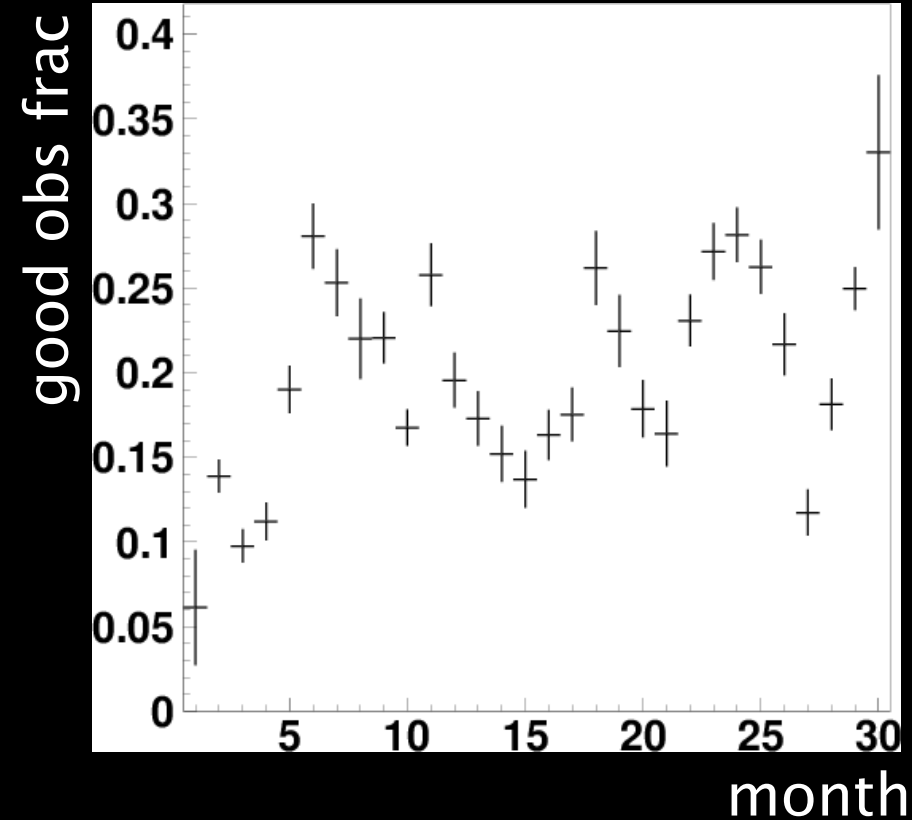
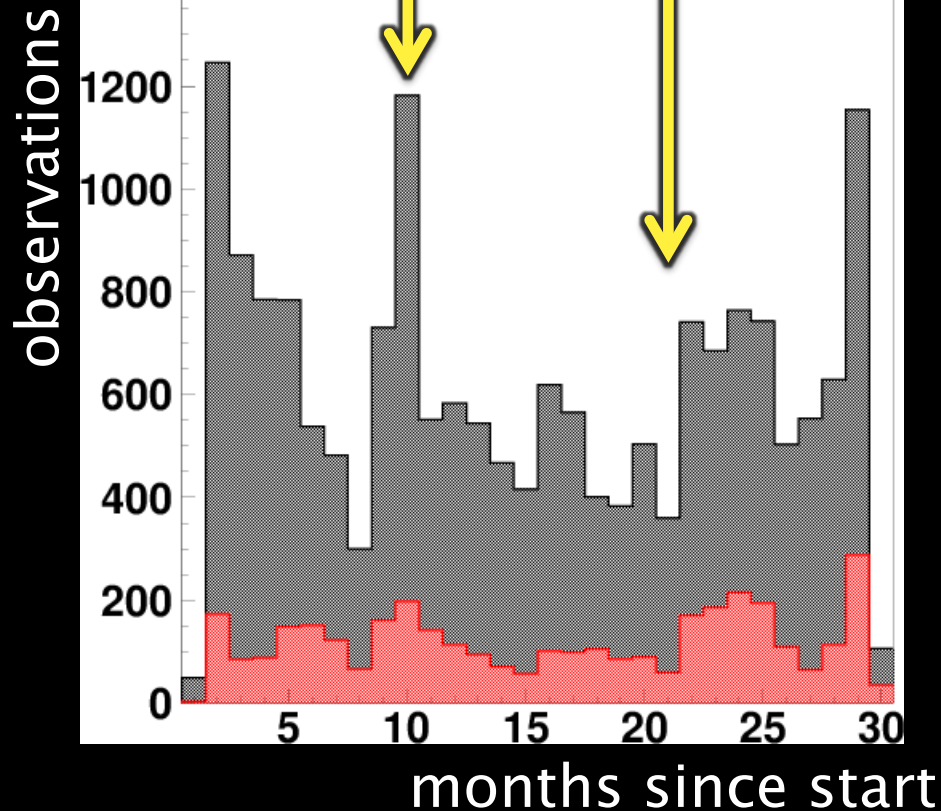
- ☐ An object is in the way
- ☐ Clouds or mist block the view
- ☐ I'm not sure if it's there or not
- ☐ Visible only with averted vision
- ☐ The star is not visible

Back

Submit

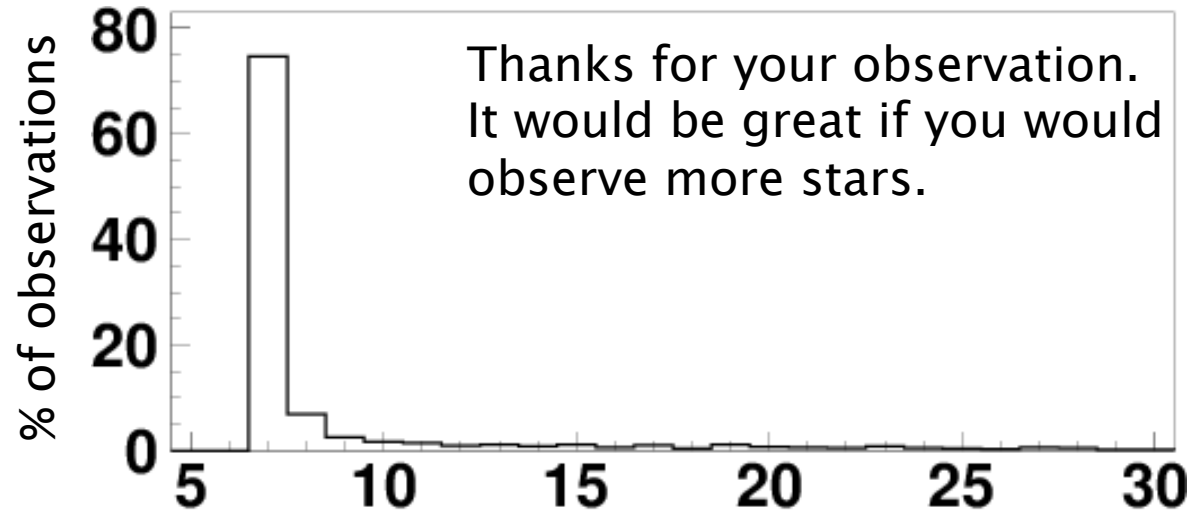
Usage by month

extra version 2
languages (+iOS)

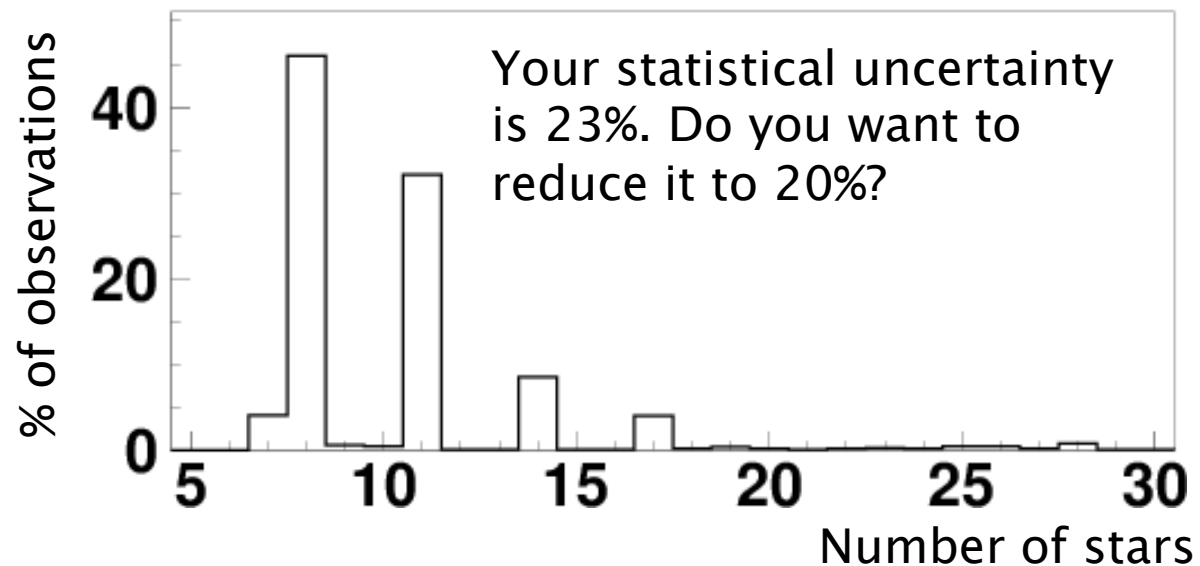


Number of stars observed

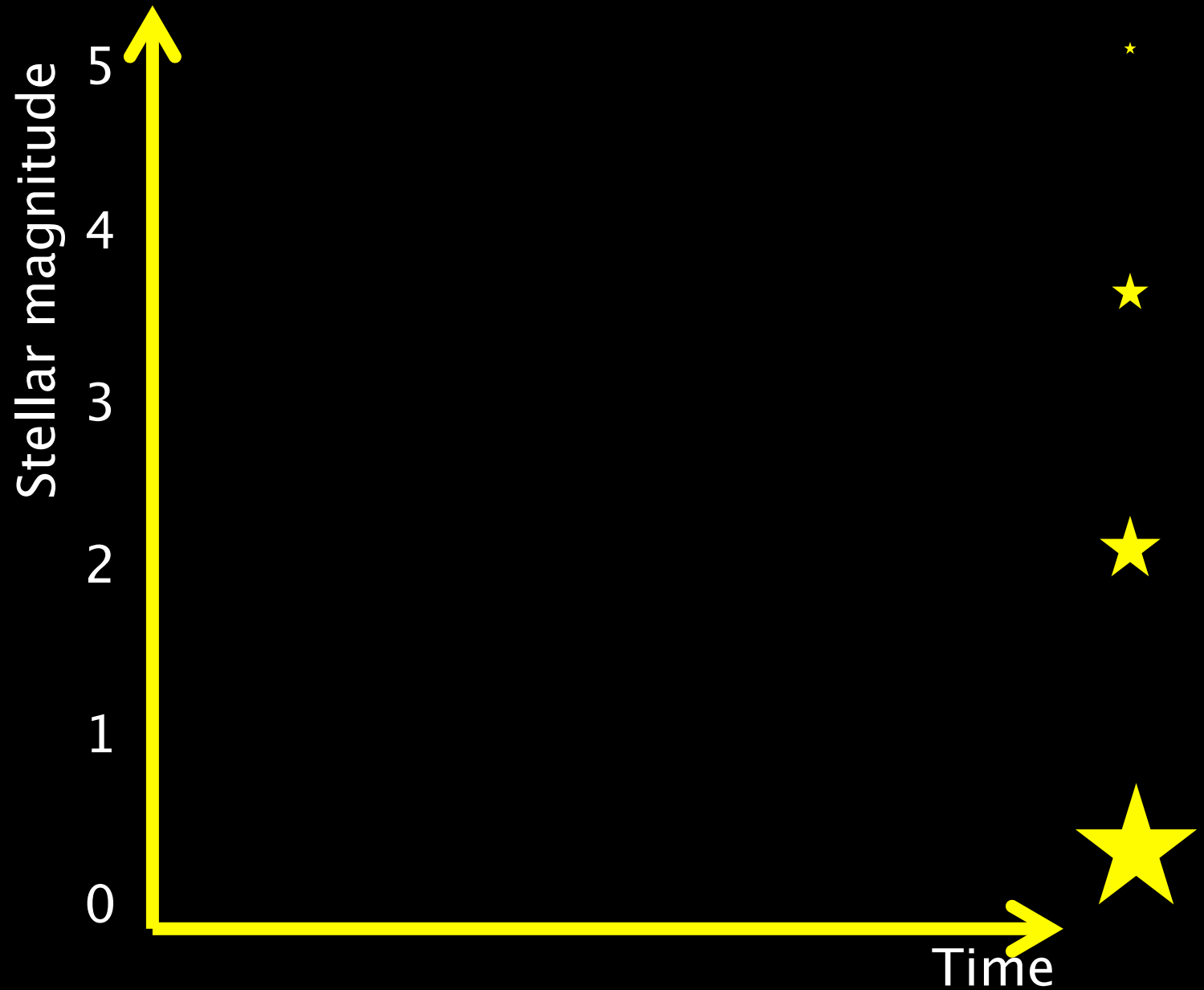
Version 1



Version 2



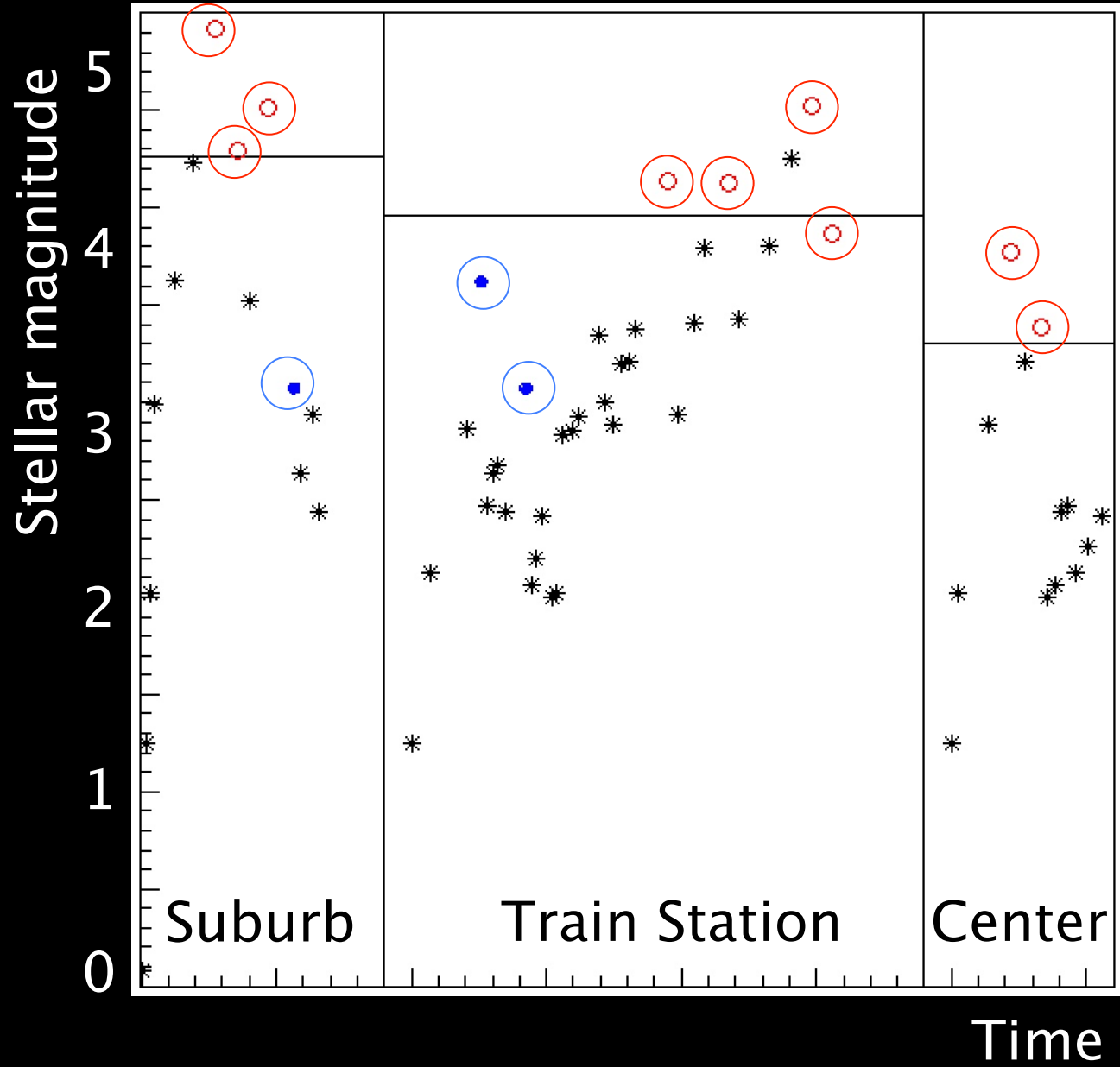
Observations



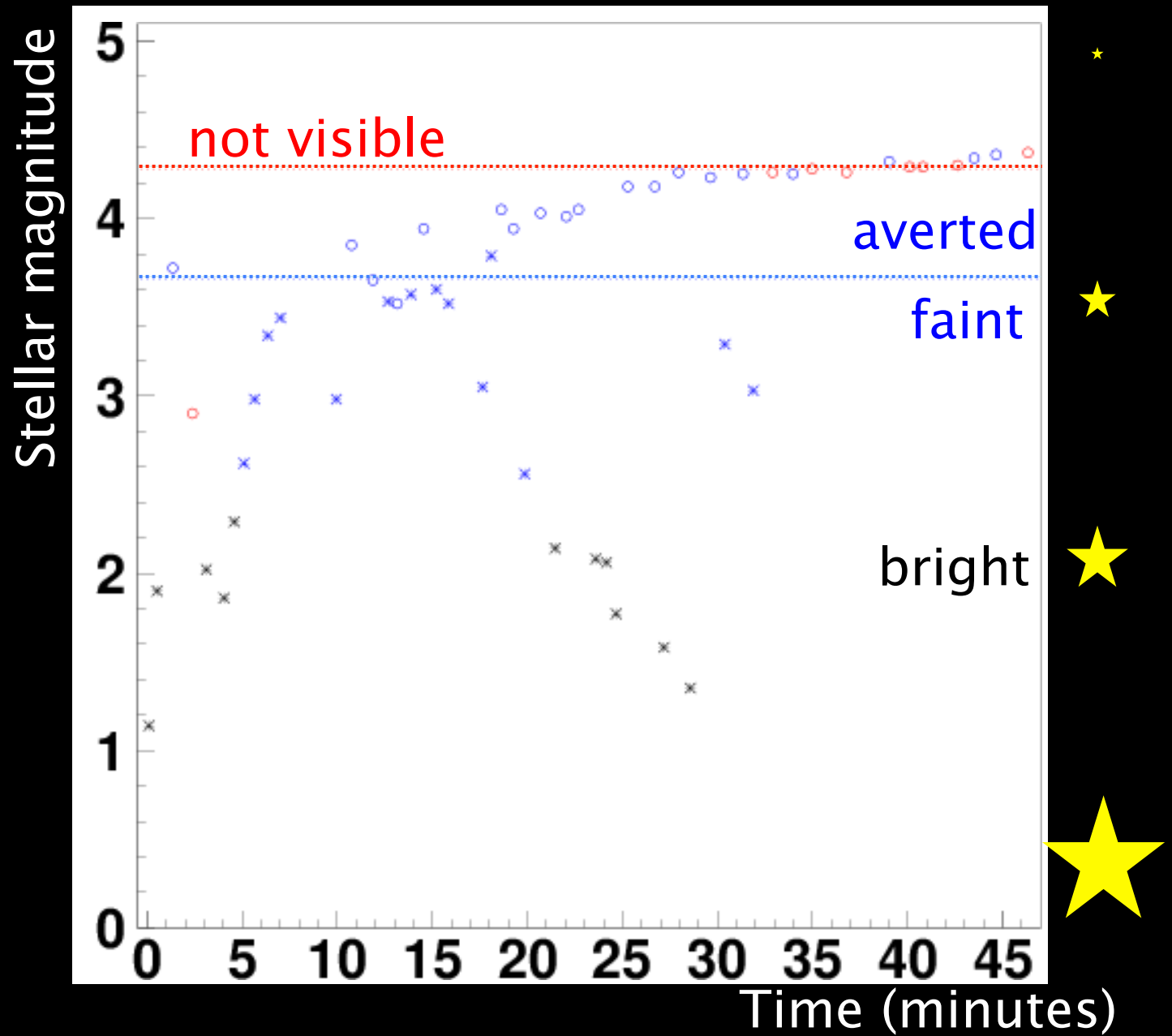
Berlin observations

not visible

unsure



Observation in Poland



How accurate is the app?

- What is the systematic uncertainty
 - due to environmental variation
 - due to shot-to-shot variation
 - due to person-to-person variation

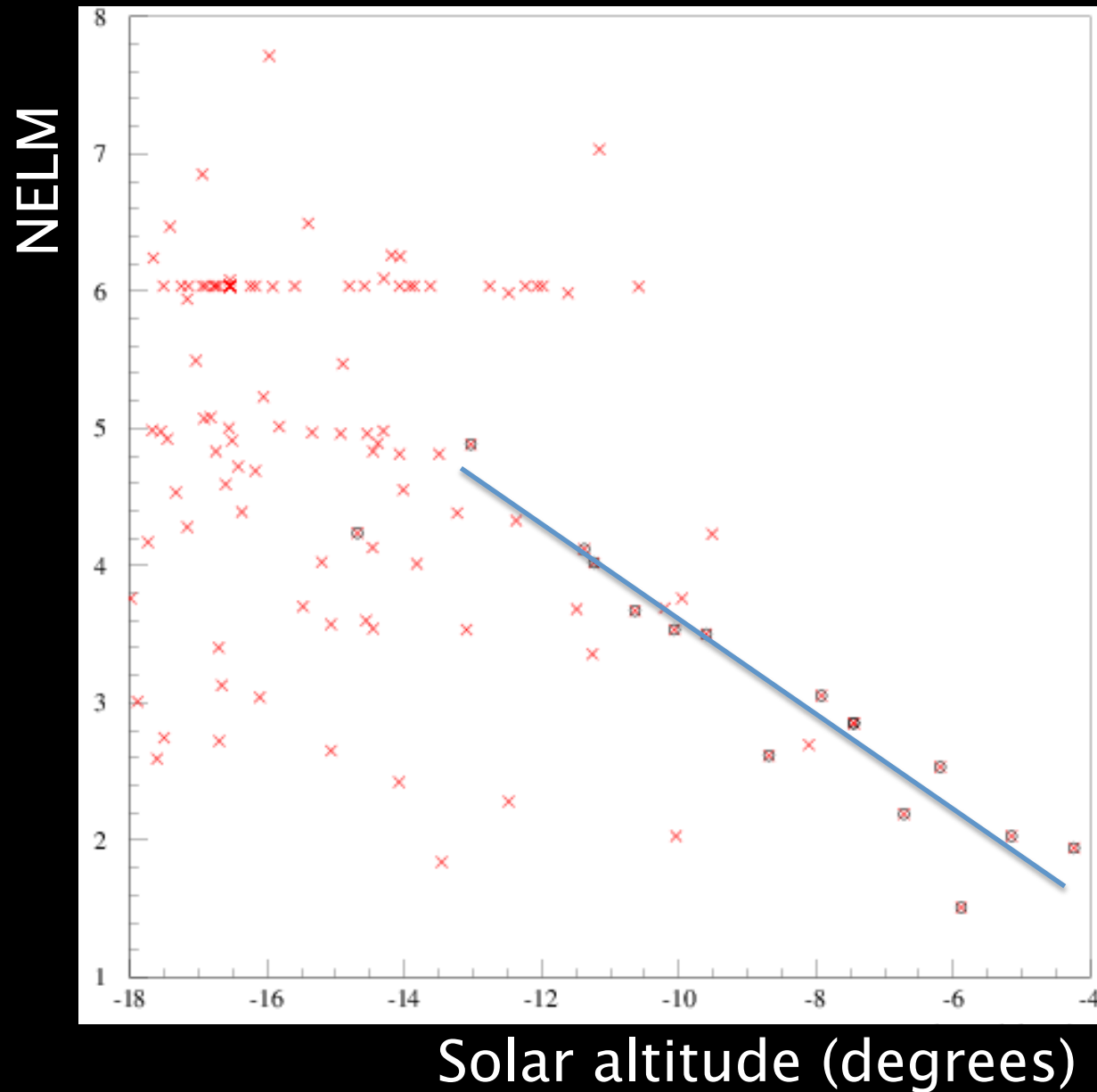
Environmental variation for a single observer

Berlin 1:	12 observations	$\sigma=0.32$
Berlin 2:	7 observations	$\sigma=0.50$
Potsdam:	7 observations	$\sigma=0.34$

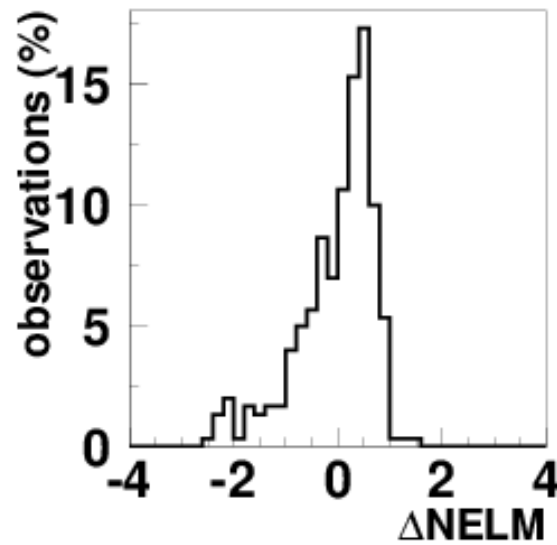
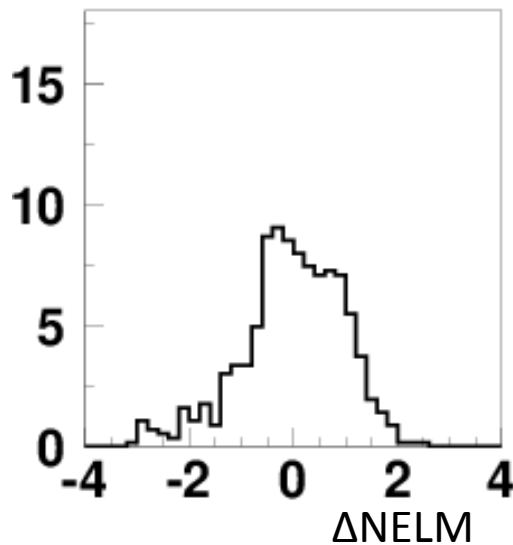
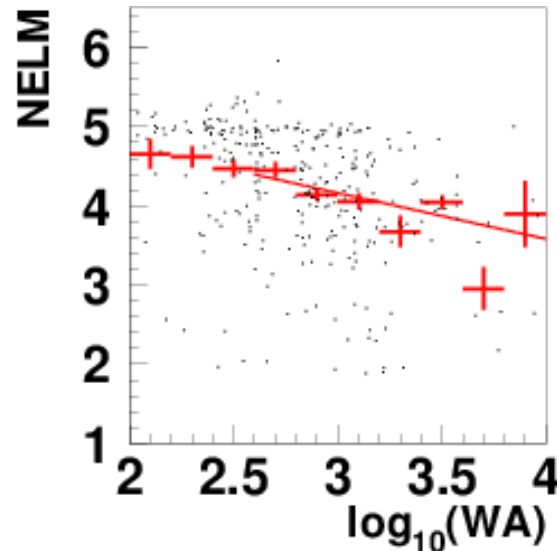
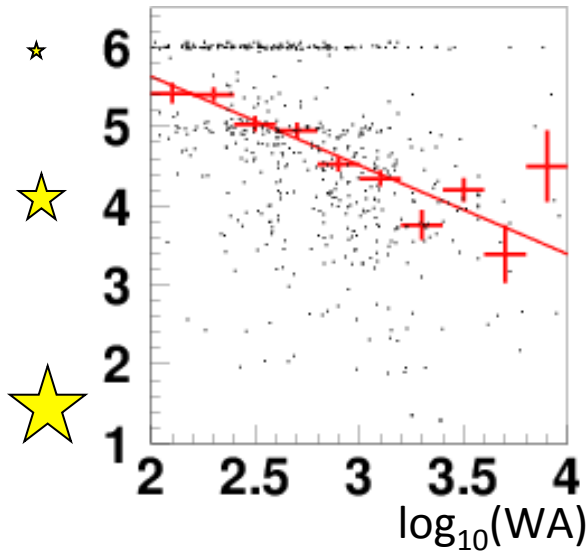
Flashmobs for Science

- Berlin (1st version of app)
 - 3.08, 3.23, 3.29, 3.39, 3.81, 4.08, 4.67, all seen (x2)
 - Sample standard deviation: ± 0.6
- Heidelberg (2nd version of app)
 - 3.99, 4.11, 4.29, 4.50
 - Sample standard deviation: ± 0.2
- Need a bigger event!

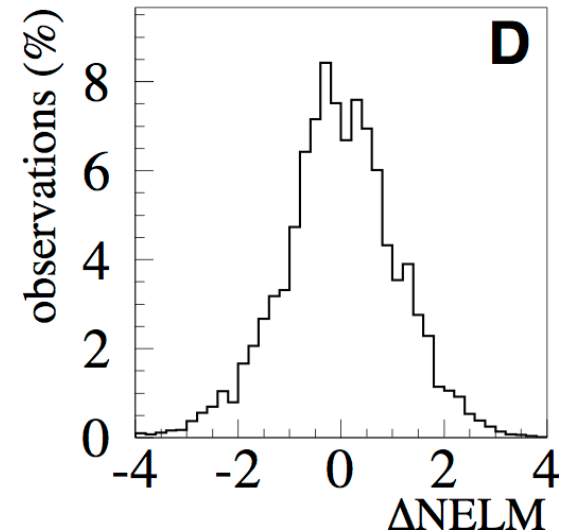
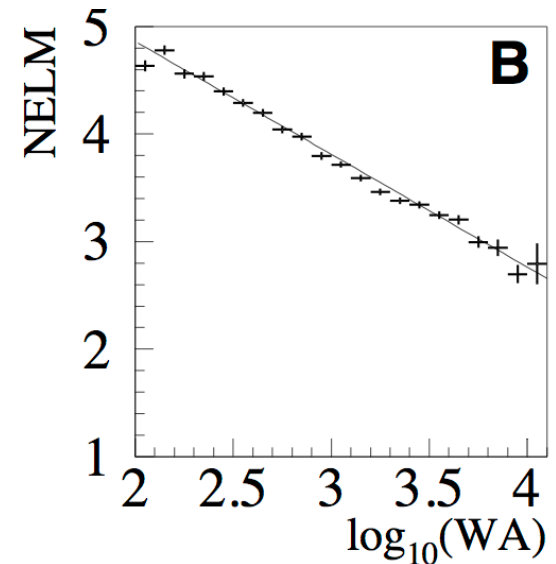
Twilight data



Person-to-person variation



Globe at Night



Acknowledgements

German Ministry of Education and Research
App testers
App users

