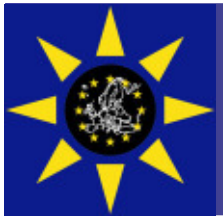


The 1st Continuous Measurements of Nightsky Brightness with a New Low Cost Luxmeter

André Müller
Max Planck Institute for Astronomy Heidelberg

Dr. Günther Wuchterl
Thüringer Landessternwarte Tautenburg

Motivation

- Quantitative statements
- 1st Continuous measurements
- Comparison between Jena – Obs. Tautenburg
- `Light weather´
- Long-time trends – disappearance of the Milky Way
- Integration in a meteorological station

Motivation

- Low costs (~100 Euro)
- Low maintenance
- Easy to operate
- Global network with 1000 stations
- Additional grid for `How many stars...´

Methods

- Conventional luxmeter
- Photometer (e.g. Zacharov, 1962)
- Simple digital camera (e.g. Schmidt, 2004)
- CCD-Camera (e.g. Cinzano et al., 2000)
- Imaging with fisheye lenses (e.g. Cristaldi et al., 2000)
- Anchor visual estimations (e.g. `How many stars...´)
- Solar cell (Kerschbaum/Posch)

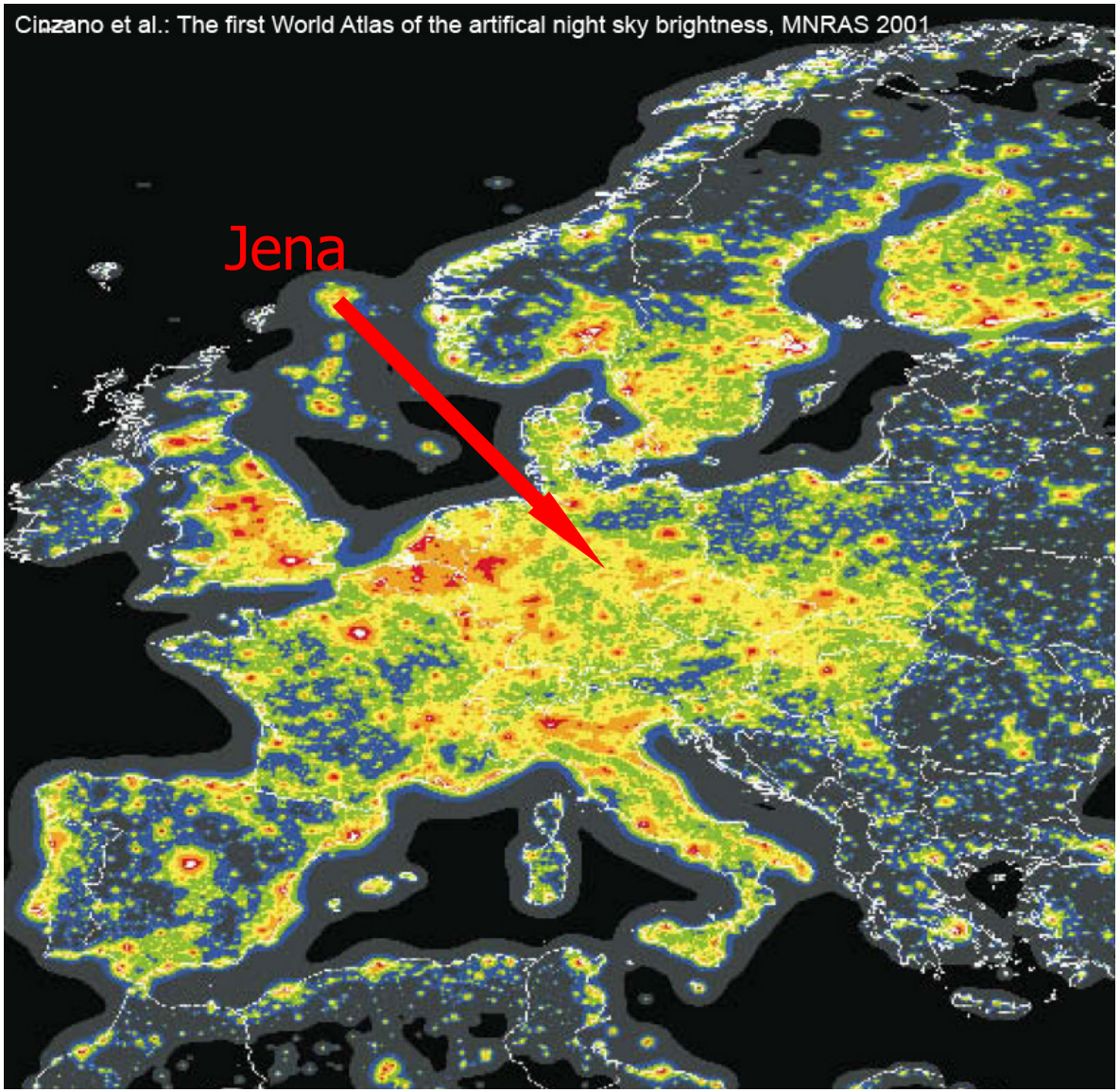
Methods - Disadvantages

- High costs
- Usage depends on weather
- Monitoring programs not always possible
- Complex data reduction and analysis
- All sky capability

Our Low Cost Luxmeter

- Using a conventional solar cell as detector
- 1st prototype developed and built in summer 2005
- 1st light 26.04.2005
- Starting with monitoring program on 3rd Nov 2005

Measuring Site



Measuring Site – Jena City

Operating for ~4 months

4m telescopic mast

transparent bowl for weather protection

Pico-Amperemeter located in temperature stable staircase

Measuring Site – TLS Tautenburg

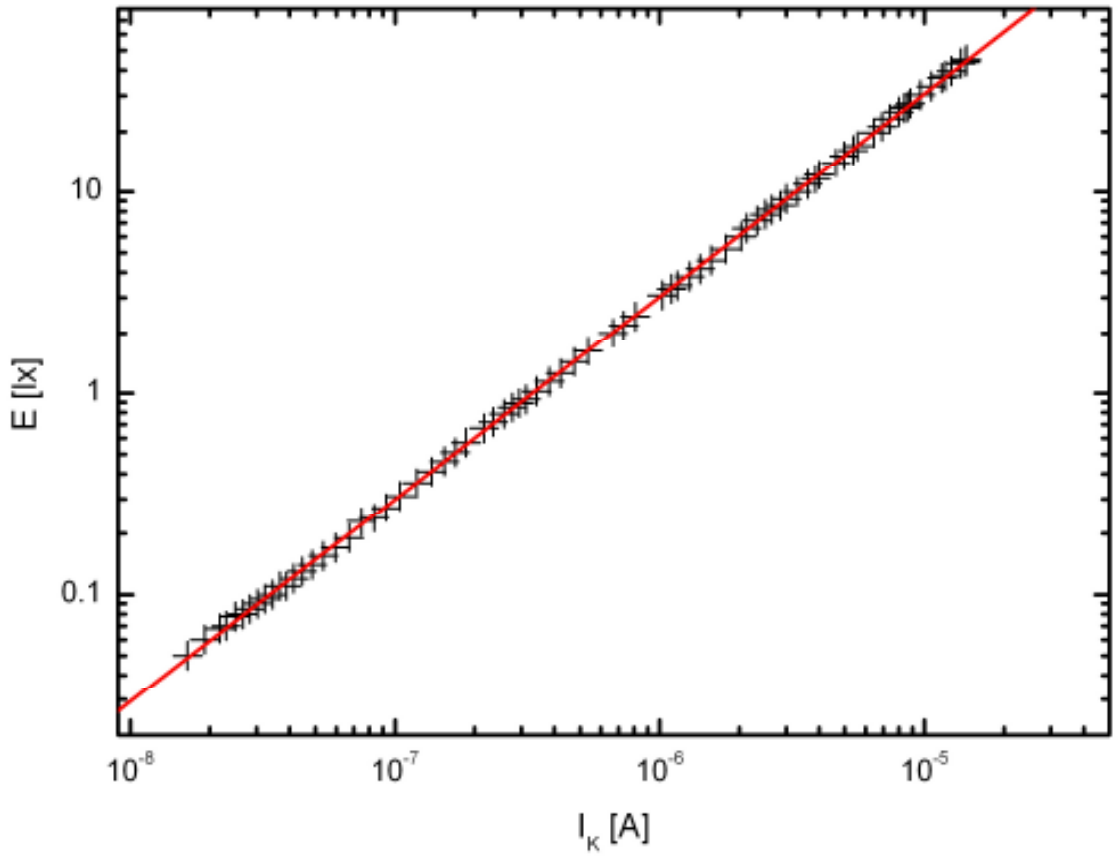
Solar Cell

Advantages

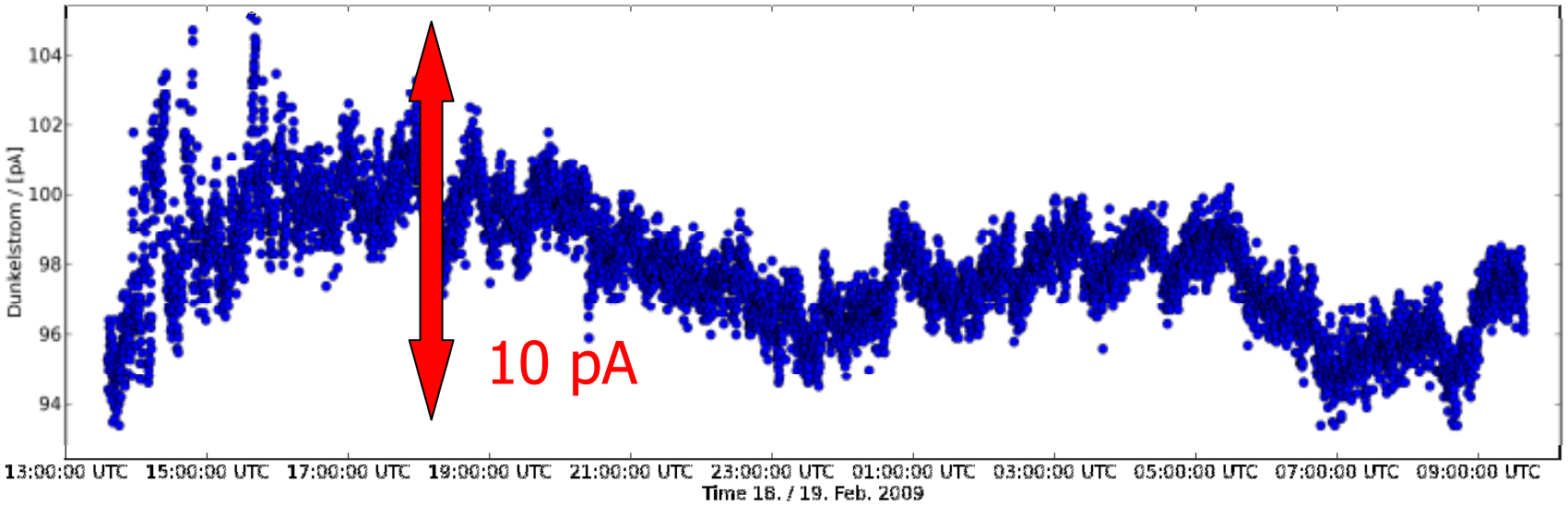
- Low costs (~100 Euro)
- Simple setup
- Continuous Measurements
- Weather independent
- Direction dependent measurements possible
- Could operate without PC and additional current (future)
- Mobility
- Measurements over 8 orders of magnitude (!)
- High resolution in time

Calibration - Linearity

- For Calibration *VOLTCRAFT* (0.01 lx - 20.000 lx) was used
- In the future automatic calibration using the moon



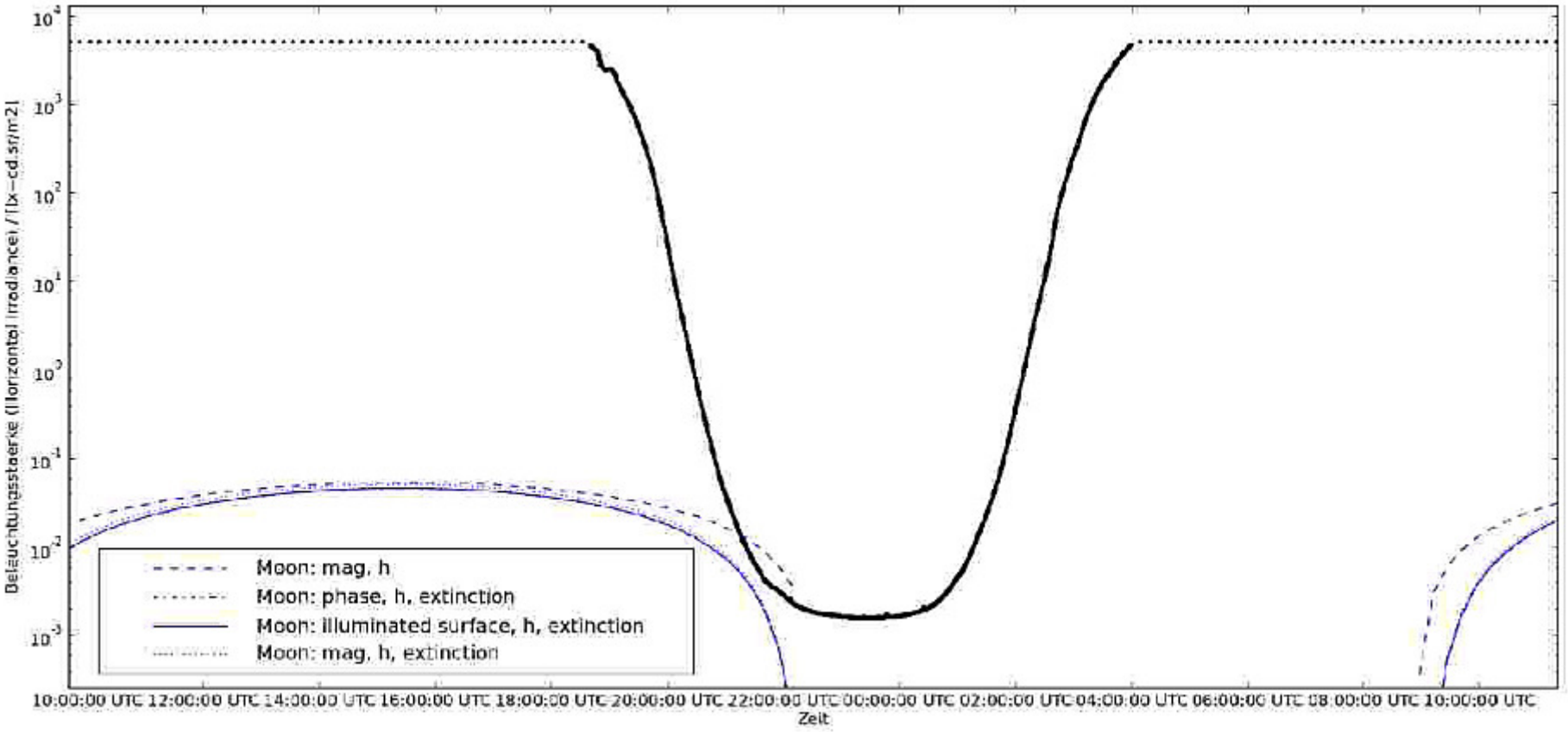
Dark Current



Lower detection limit ~50-100 µlx
(natural night sky brightness ~250 µlx)

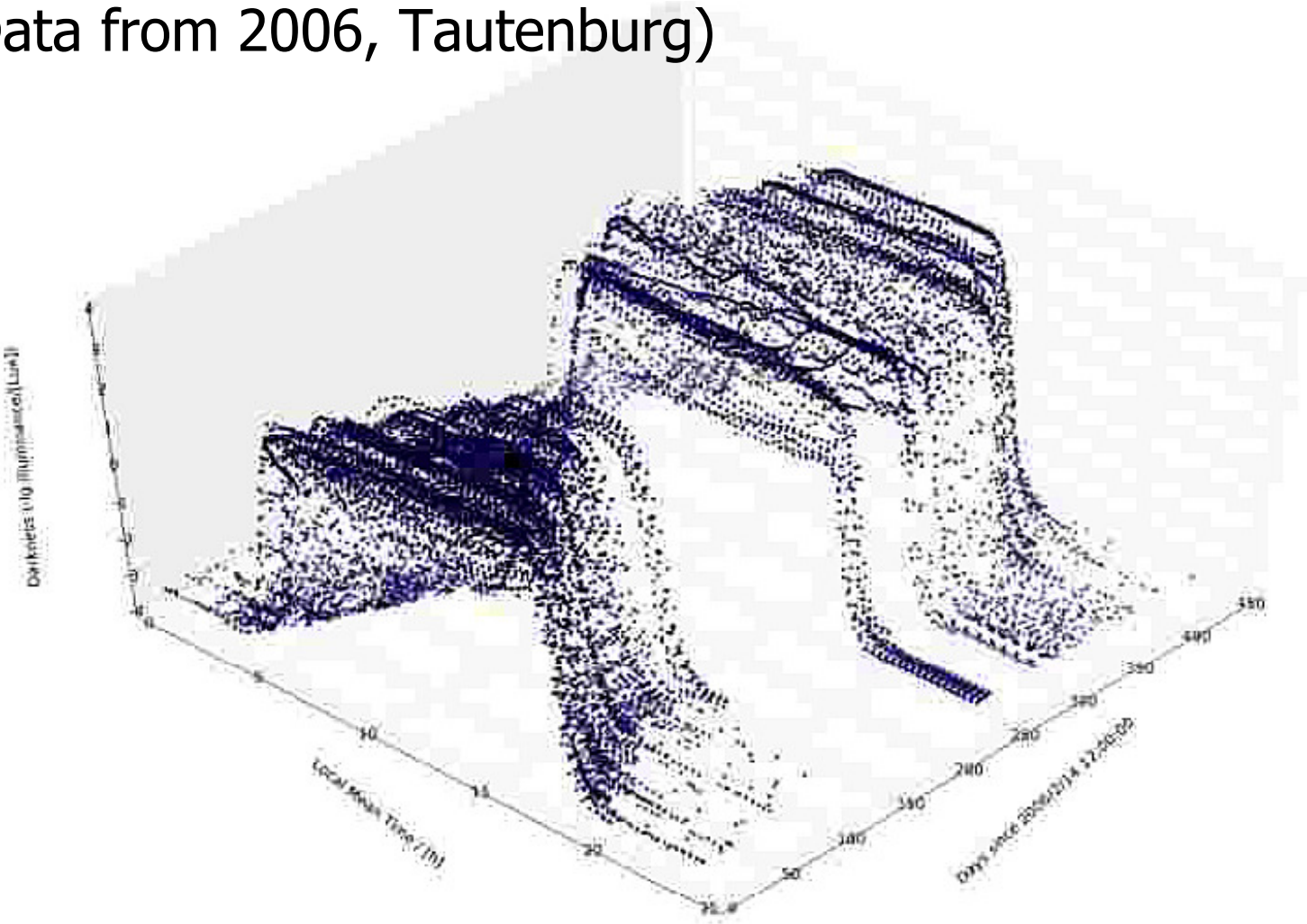
First Results - Examples

Darkest night in Tautenburg



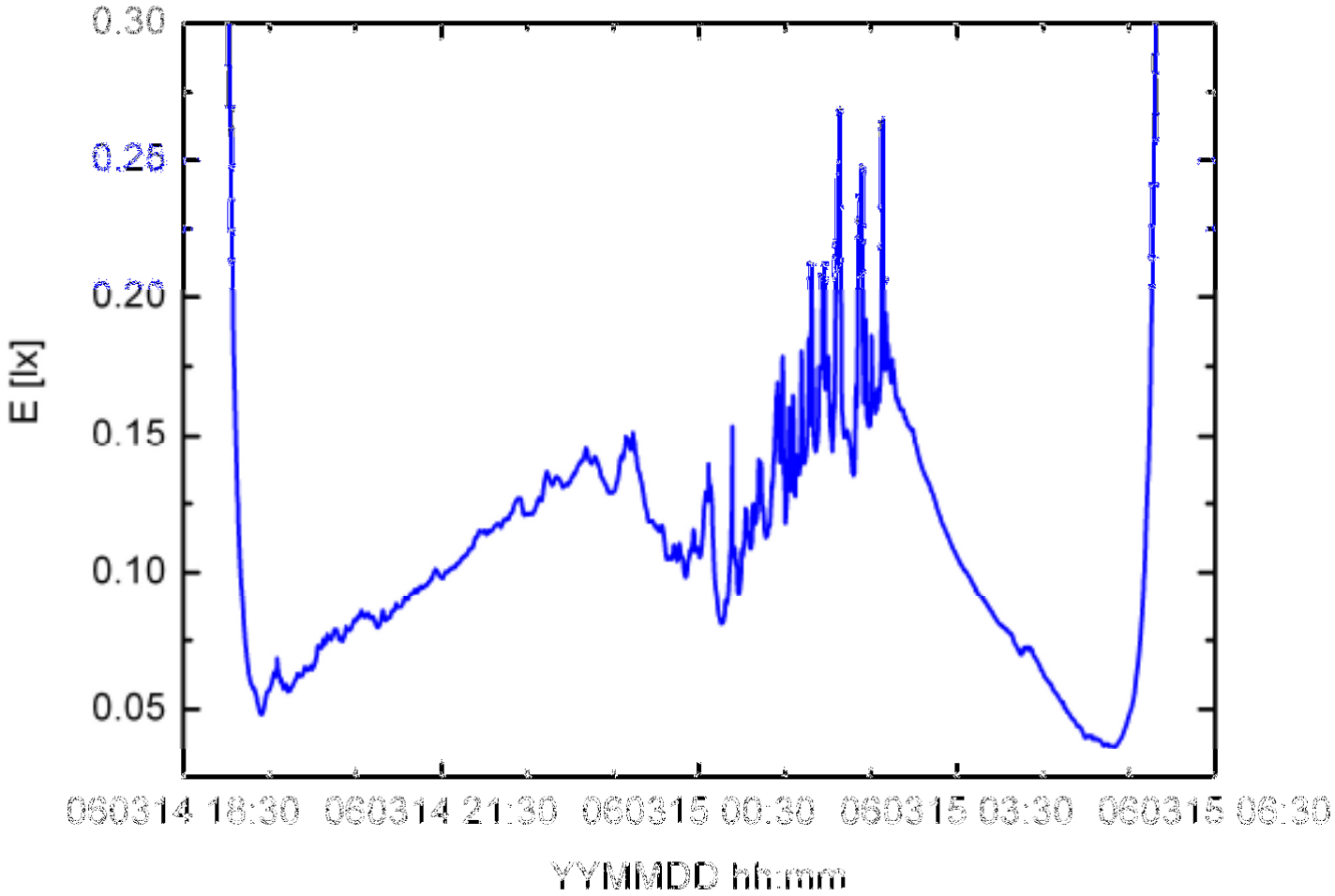
First Results - Examples

Change of night length
(Data from 2006, Tautenburg)



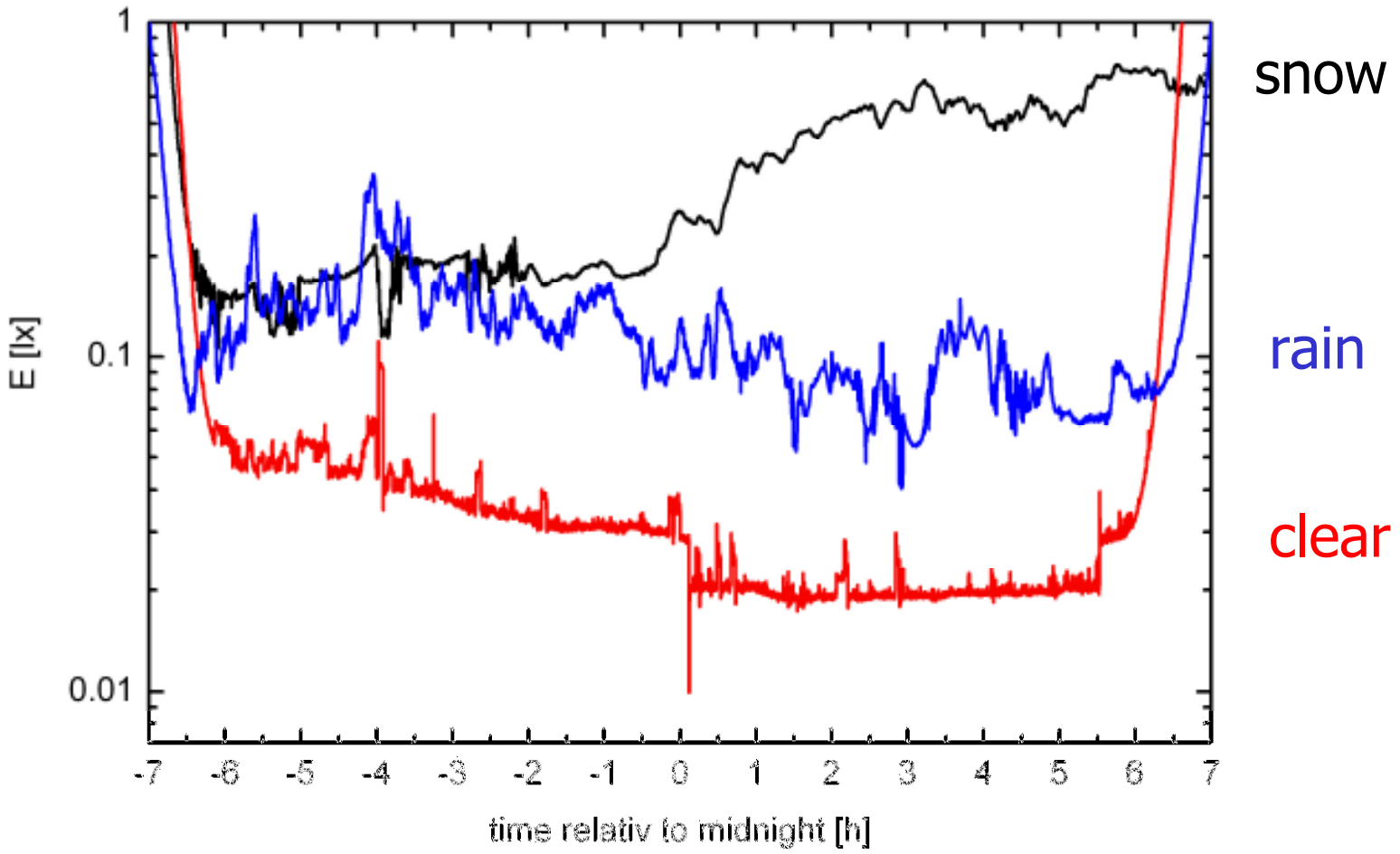
First Results - Examples

Night with full moon and clouds



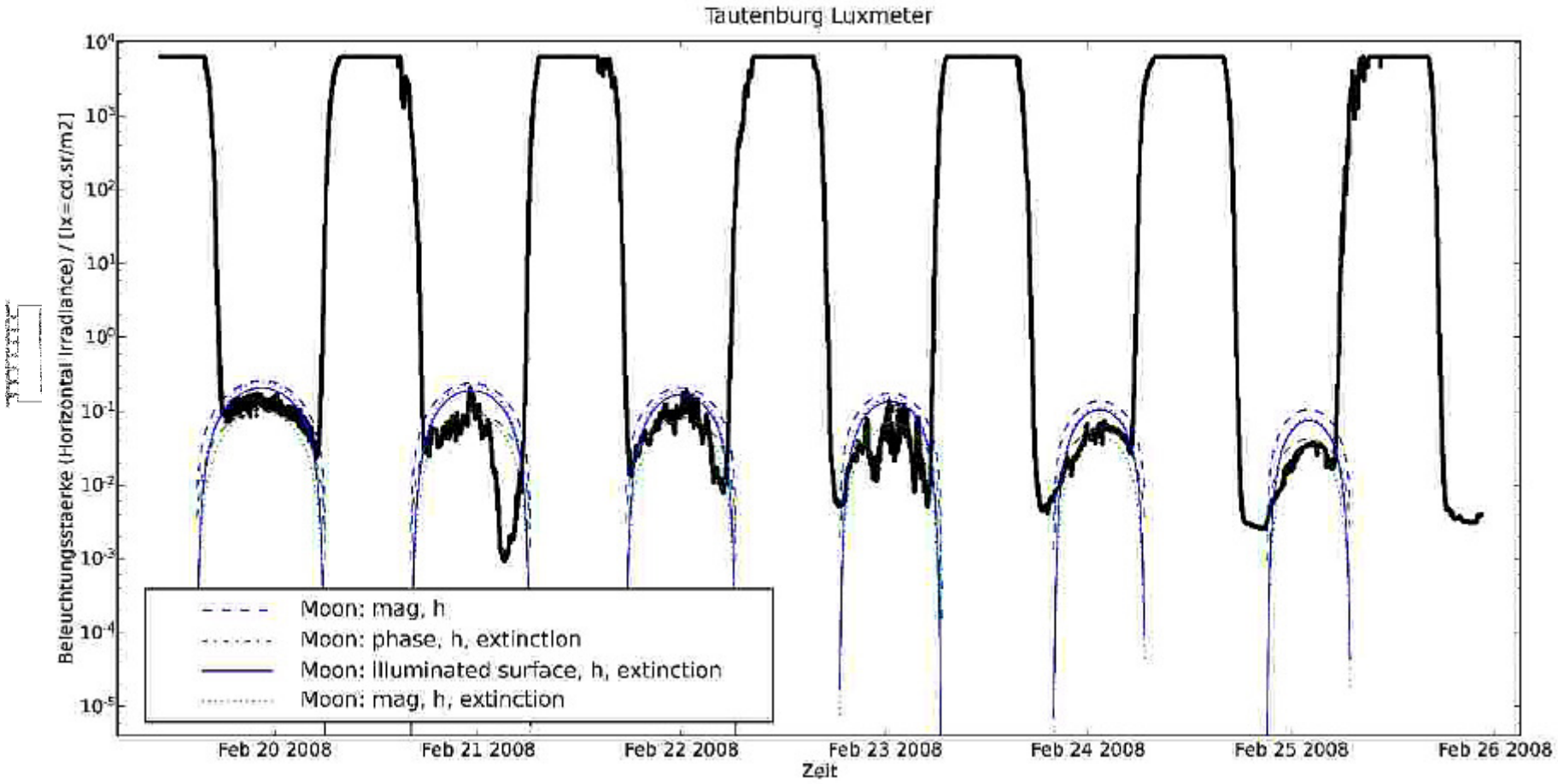
First Results - Examples

Influence of weather



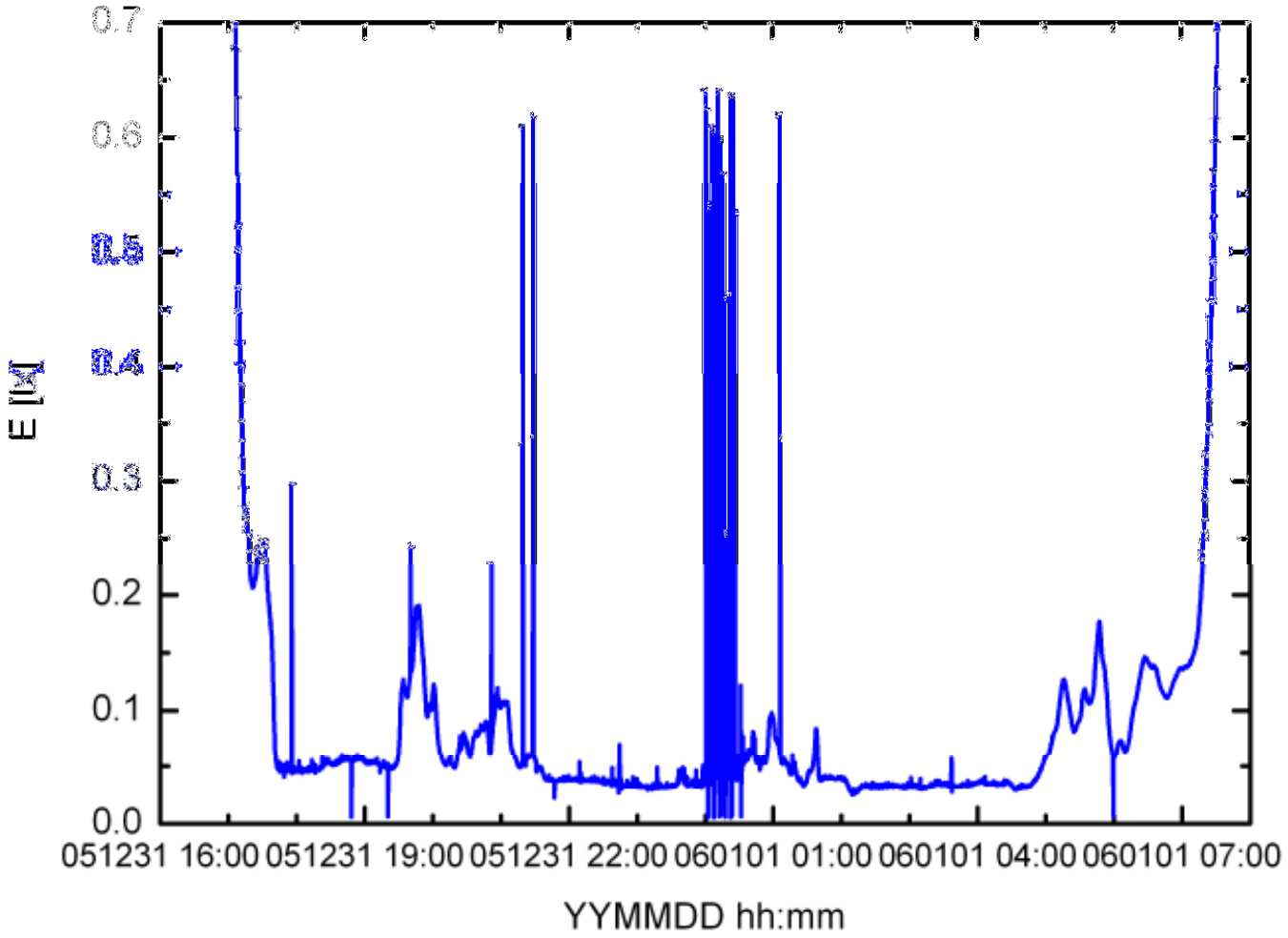
First Results - Examples

Modulation of illumination due to the moon

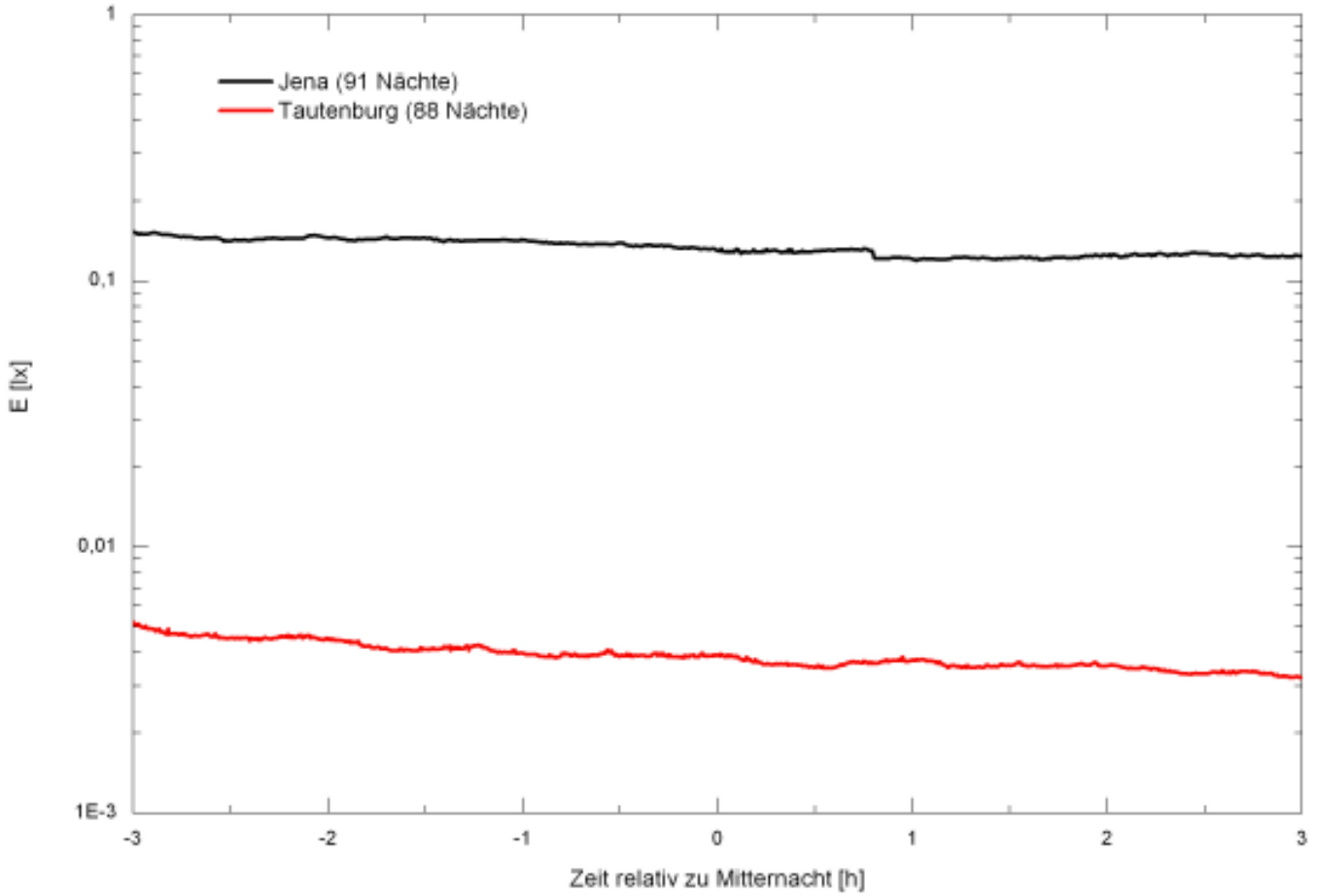


First Results - Examples

New Year's Eve 2005/2006



Jena - Tautenburg

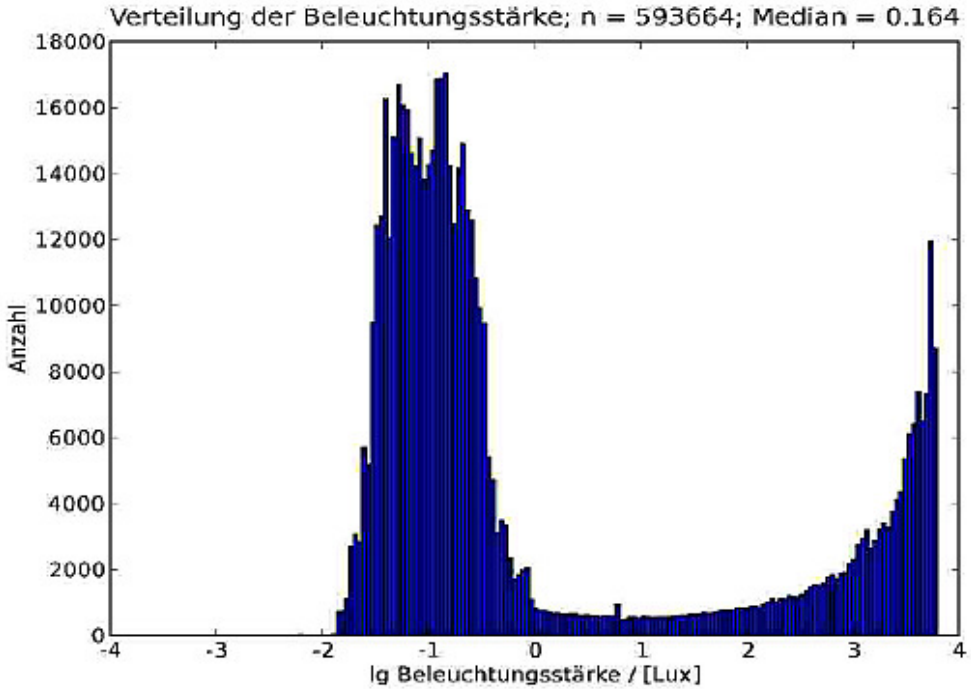


>1/2 E(full moon)

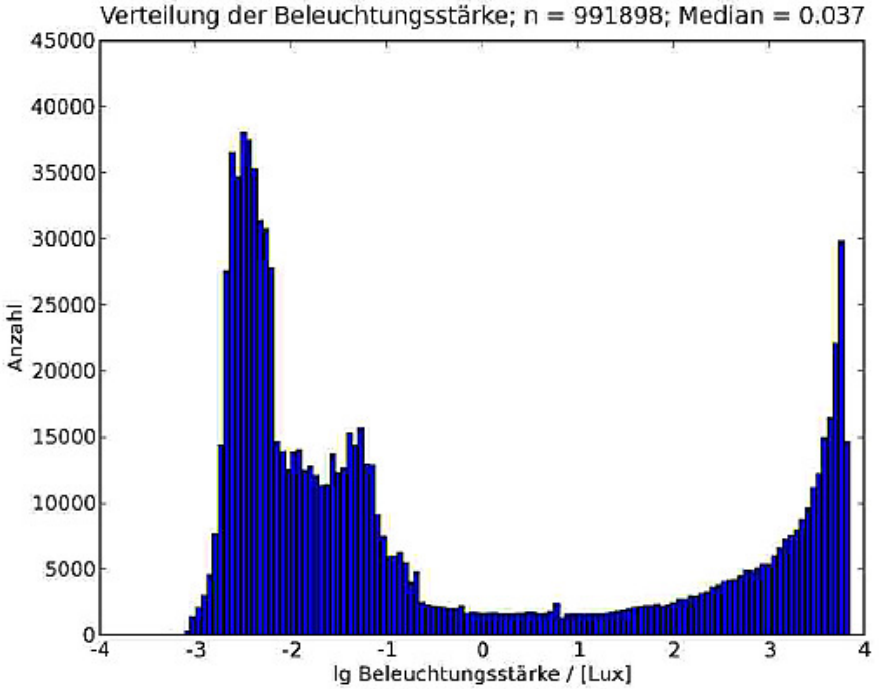
Jena is at least 40 times brighter than Tautenburg

Jena - Tautenburg

Jena Nov 2005 – Jan 2006

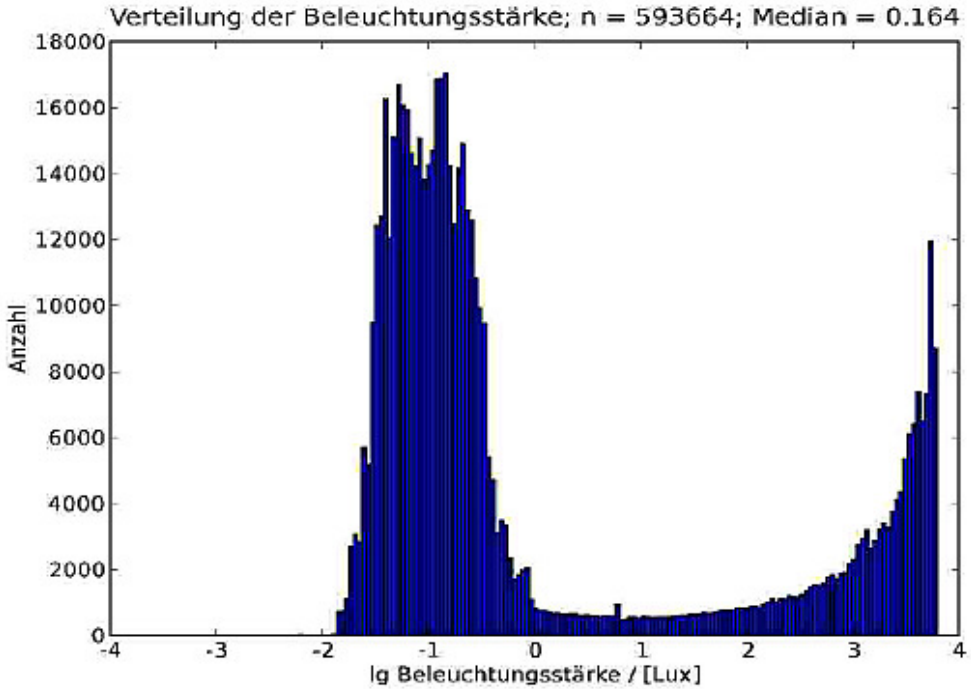


Tautenburg 2006

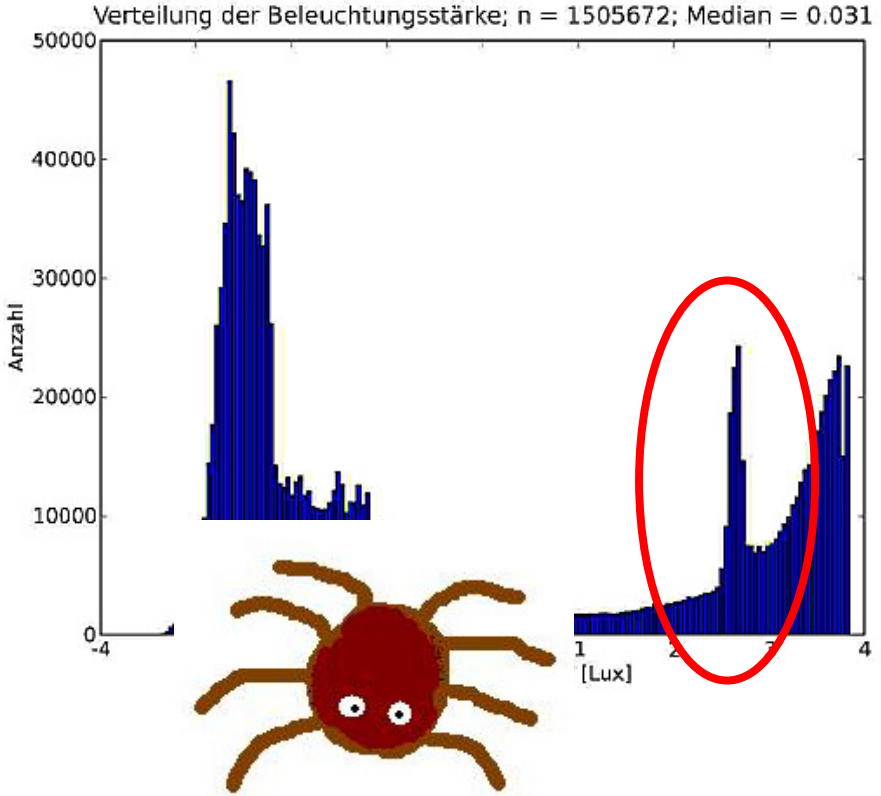


Jena - Tautenburg

Jena Nov 2005 – Jan 2006



Tautenburg 2007



Darksky 2008

First Results - Examples

Night with full moon