DARK SKY PARK PROGRAM

Zoltán Kolláth
EÖTVÖS LORÁND UNIVERSITY, SZOMBATHELY, HU
IDA DARK SKY PLACES COMMITTEE

Why it is important?

Artificial Light at Night (ALAN):

Increasing level of light pollution

Disturbance of nocturnal habitats and biological clock; effects on biodiversity

Human health

Nocturnal landscape

Visibility of celestial objects – starry sky

Increasing ALAN

ALAN is increasing faster than:

- The world's population
- Total GDP
- Total energy consumption

A recent threat

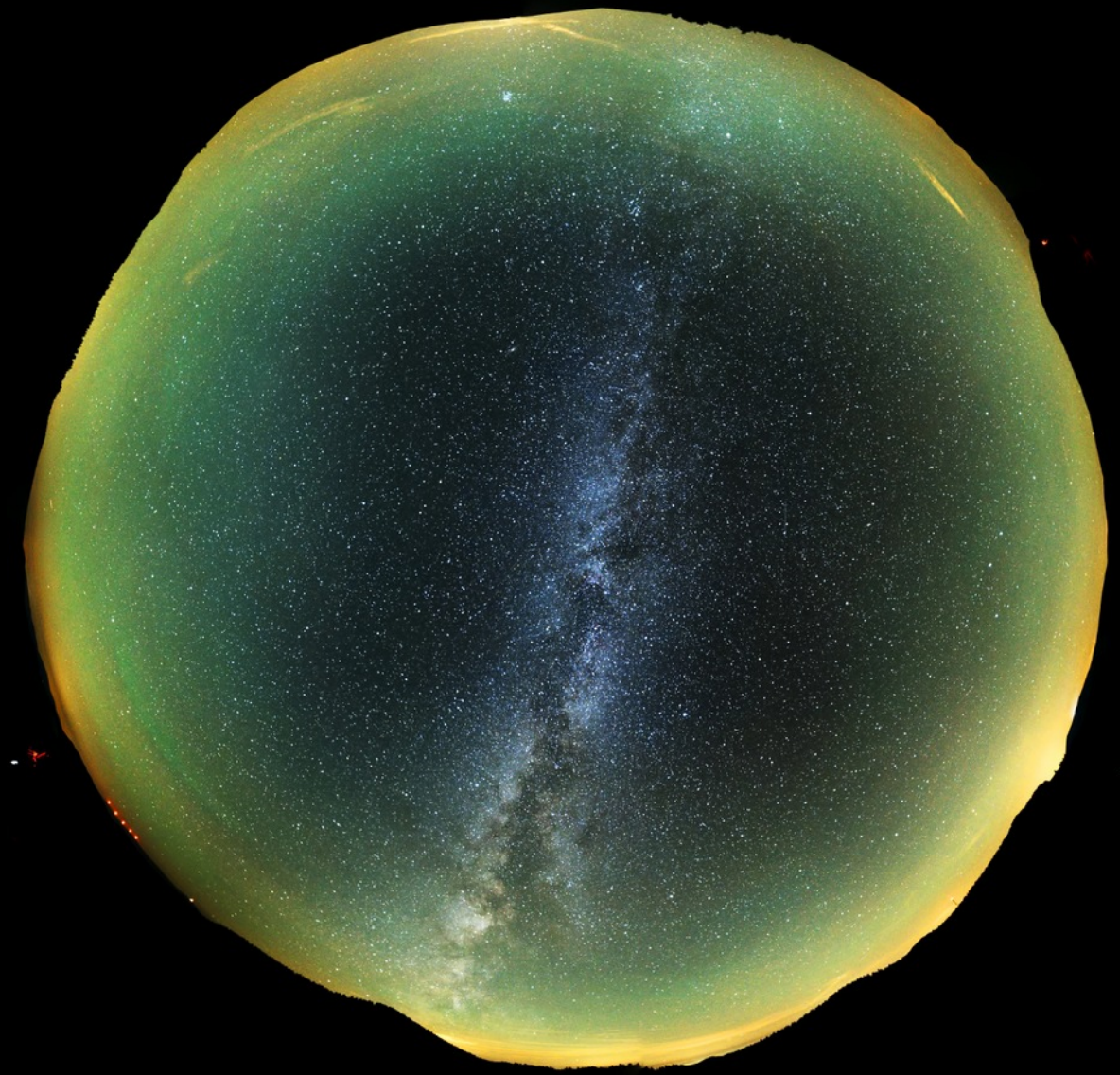
- Sodium → LED
- Increased blue content
- Cheaper light → rebound effect

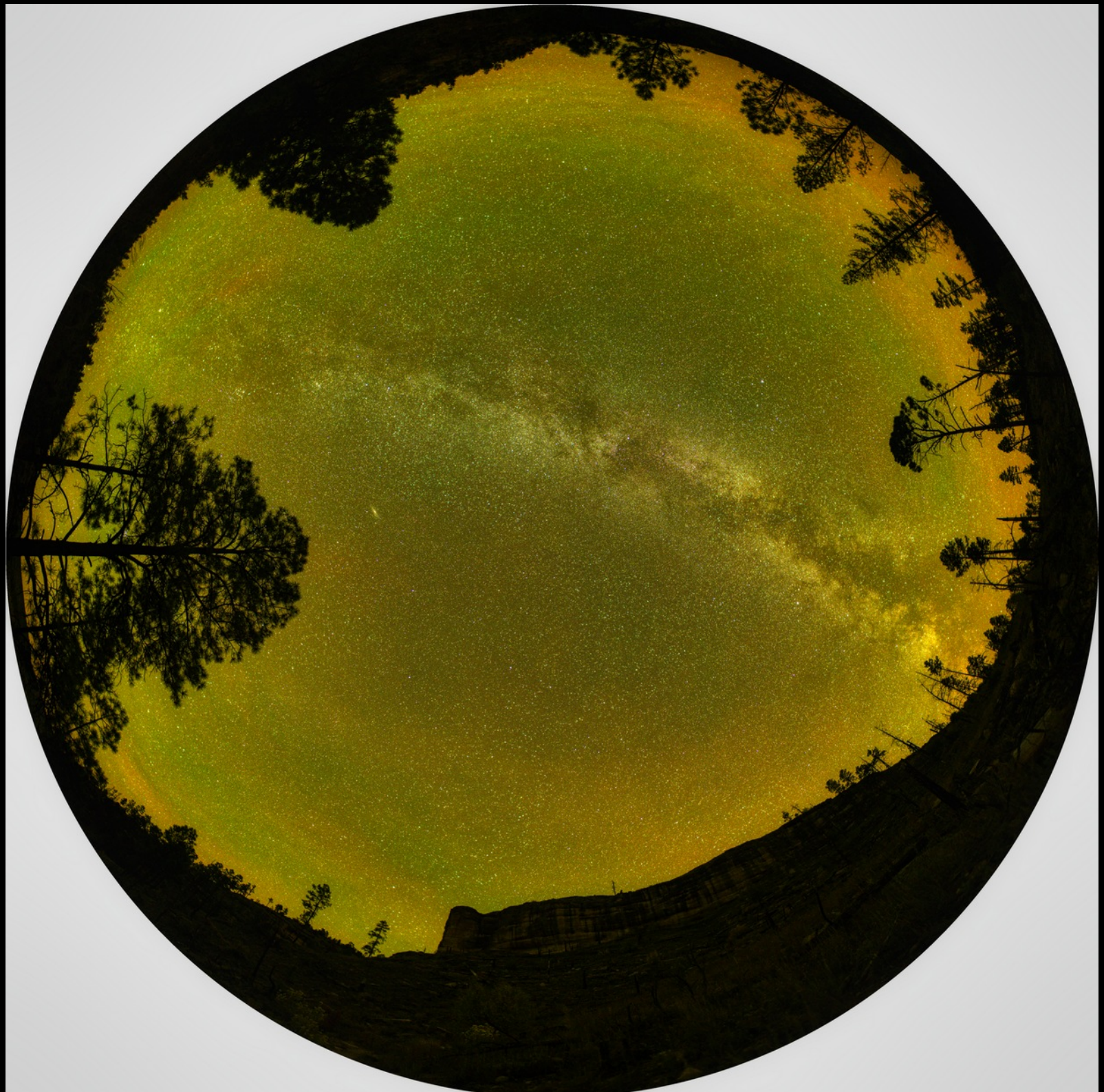
Zselic Starry Sky Park – 2014

Zodiacal light

Gegenschein

Airglow (Padis, Apuseni Nature Park)





Dark sky programmes worldwide

- IAU-UNESCO – Astronomy and world heritage
  https://www3.astronomicalheritage.net/index.php

- Starlight Foundation
  https://www.fundacionstarlight.org/en/index.php
-
- Parks Canada –
  https://www.pc.gc.ca/en/nature/science/conservation/ciel-sky

- US NPS – Night sky program
- **IDA – international dark sky parks, reserves, communities**
  https://www.darksky.org

- **Some self declared dark sky parks – problem: quality control (e.g. IDA requires annual reports, ...)**

International Dark Sky Places

An international program led by the International Dark-Sky Association (IDA)

International Dark Sky Parks

International Dark Sky Reserves

International Dark Sky Communities

International Dark Sky Sanctuaries

Goals of dark sky park creation

- To identify, restore, and protect public lands (national, state, provincial, and other parks and notable public lands), and publicly accessible private lands, with exceptional commitment to, and success in implementing, the ideals of dark sky preservation and outstanding night skies.
- To promote eco-- and astro--tourism;
- To promote protection of nocturnal habitat and human health, public enjoyment of the night sky and its heritage, and/or areas ideal for professional and amateur astronomy;
- To encourage park administrators to recognize dark skies as a valuable resource in need of proactive protection;
- To provide national and international recognition for such parks;
- To encourage parks and similar public entities to become environmental leaders on dark sky issues by communicating the importance of dark skies to the general public and surrounding communities, and by providing an example ofwhat is possible with proper stewardship.

INTERNATIONAL DARK SKY PARKS

International Dark Sky Park Program Guidelines

June 2018

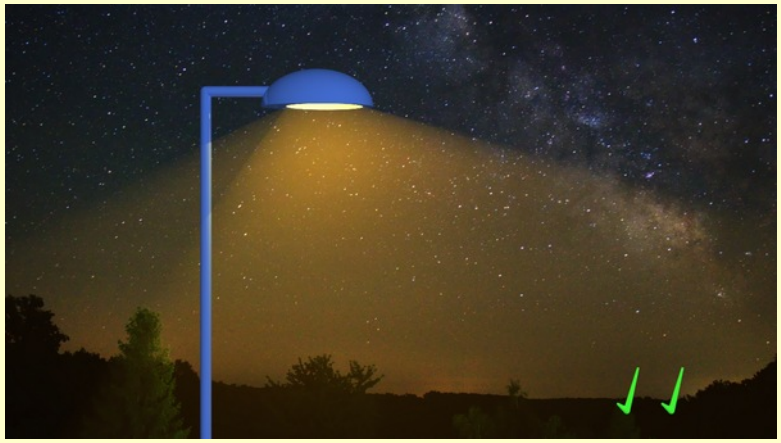
International Dark Sky Parks by IDA

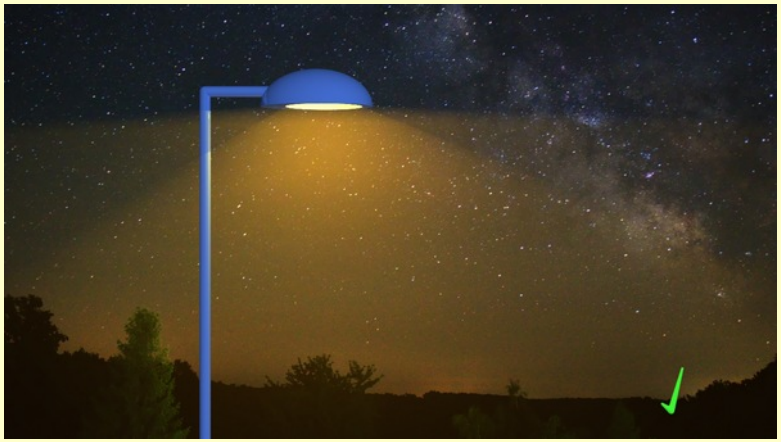
Eligibility

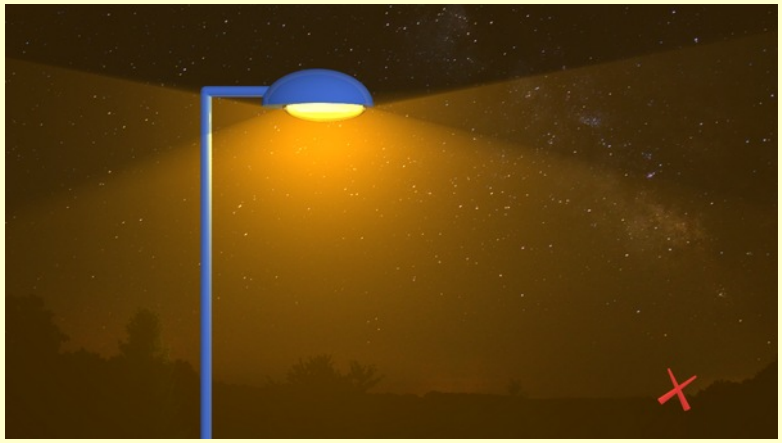
- Protected public land (management plan)
- Night time public access
- Exceptional night sky quality

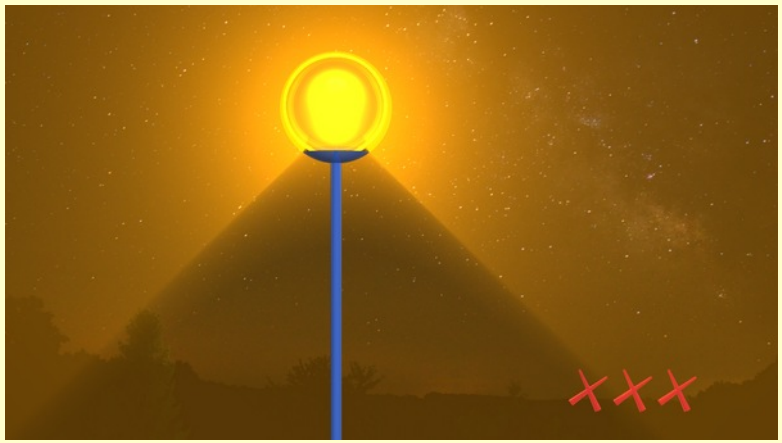
Required elements

- Lightscape Management Plan (LMP)
- Lighting must meet the LMP
- Fully shielded fixtures (above 500lm)
- Colour temperature below 3000K (<2200 recommended)
- Evidence of commitments to dark skies
- Commitment to public education









Eligibility

All protected public lands, whether managed by national, state, provincial, or local agencies, are eligible2. These may include parks, refuges, forests, wilderness areas, monuments, protected rivers, or other categories of protected lands. Private lands whose owners consent to regular nighttime public access to designated areas of their property in perpetuity are also eligible. Collectively, all public or private lands contemplated in this section are hereafter referred to generically as “parks”.

The Park must provide the **opportunity for public nighttime access**, with or without supervision. A portion of designated land may meet this requirement, or access must be available for a fraction of the length of the night. In some cases, such as when working with areas that protect endangered wildlife, archeological sites, or other sensitive resources, this requirement may be adjusted. Public access to public or private lands may be subject to a nominal entry fee, but must not be contingent on the required paid use of any other product, service, program or facility available at the site.

The Park must provide an **exceptional dark sky resource**, relative to theland s and communities that surround it.

Requirements

The **Park's commitment to dark skies** and quality outdoor lighting are demonstrated by **all of the following**:

A) The Park recognizes **dark skies as an important natural, cultural, and/or scientific resource value** as demonstrated by inclusion in approved management documents4.

B) **At least two-thirds (67%) of existing outdoor lighting fixtures** within Park boundaries conform to the Park's LMP at the time of IDSP application (or an alternative fraction approved by the Dark Sky Places Committee.

C) A lighting inventory and **a plan to bring 90% of outdoor lighting into compliance** with the Park's LMP within five (5) years of receiving an IDA designation, as well as a written commitment to bring the Park into 100% compliance within ten (10) years of designation.

D) A **measurement program** must be maintained either by the Park, private landowner(s), or by another public or private organization (university, research center, IDA chapter, astronomy club, etc.) to follow the evolution of light pollution in the IDSP and assure that the night sky quality does not degrade.

Requirements

Lighting must be chosen to minimize the amount of short-wavelength light emitted into the night time environment. The Park's LMP must restrict lighting in this respect according to one of the following prescriptions:

A) The correlated color temperature (CCT) of lamps must not exceed 3000 Kelvins; **OR**

B) Allowed lighting must not emit more than 25% of its total spectral power at wavelengths < 550 nanometers; **OR**

C) The scotopic-to-photopic (S/P) ratio of allowed lighting must not exceed 1.3.

Sky quality requirements

Typical nighttime conditions characterizing the site must be consistent with or exceed the following criteria:

A) The Milky Way is readily visible to the unaided eye;

B) There are no nearby artificial light sources yielding significant glare; and

C) Any light domes present are dim, restricted in extent, and close to the horizon.

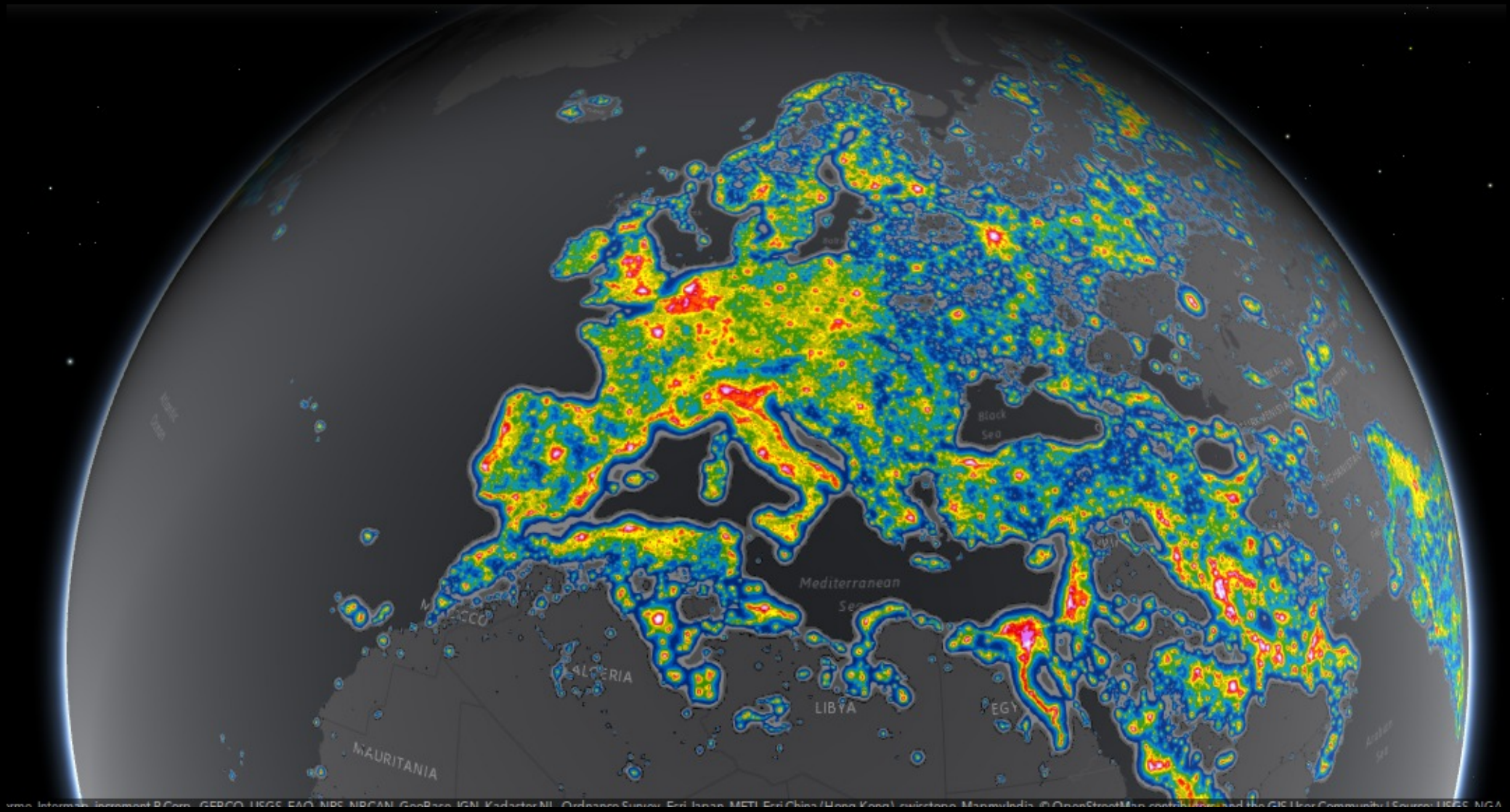
These conditions correspond approximately to a visual-band zenith luminance of 21.2 magnitudes per square arcsecond (0.4 mcd/m2) and a nakedeye limiting magnitude (NELM) of +6. In order to substantiate the sky quality, measurements of the night sky brightness at the zenith must be made with suitable instruments, or the NELM estimated by a qualified observer. Measurements of night sky brightness must be distributed over a sufficiently long enough period of time in order to average out fluctuations over timescales ranging from hours to seasons in length. Further, panoramic nighttime photography of the horizon must be included in order to substantiate the number and extent of light domes visible from the site.

Qualifying night sky

Satellite imagery

Light pollution maps based on space photometry (Falchi et al. 2016)

Source: Falchi et al. 2016
www.arcgis.com



Source: Falchi et al. 2016

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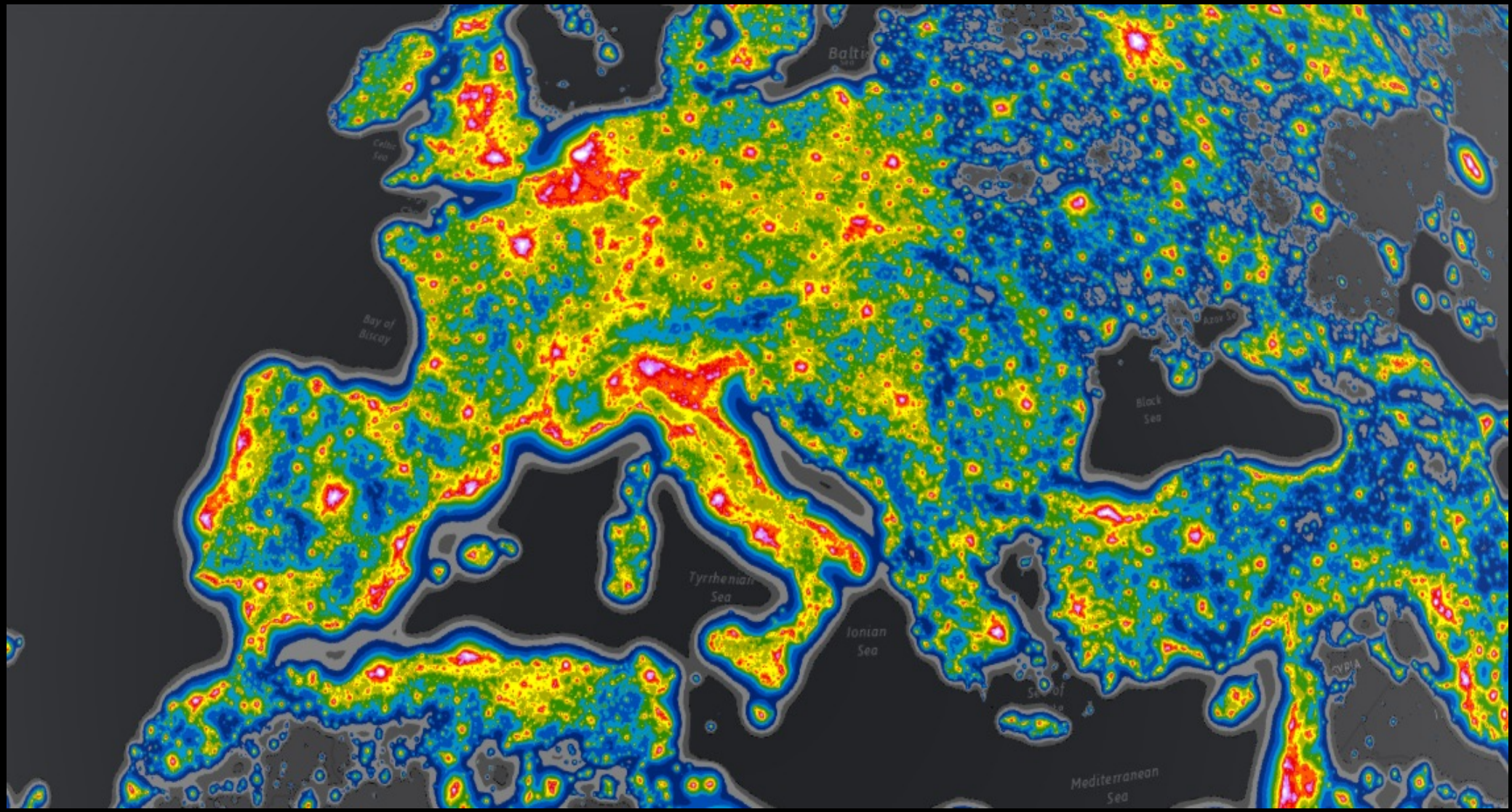


Qualifying night sky

Illuminance / liminance measurements

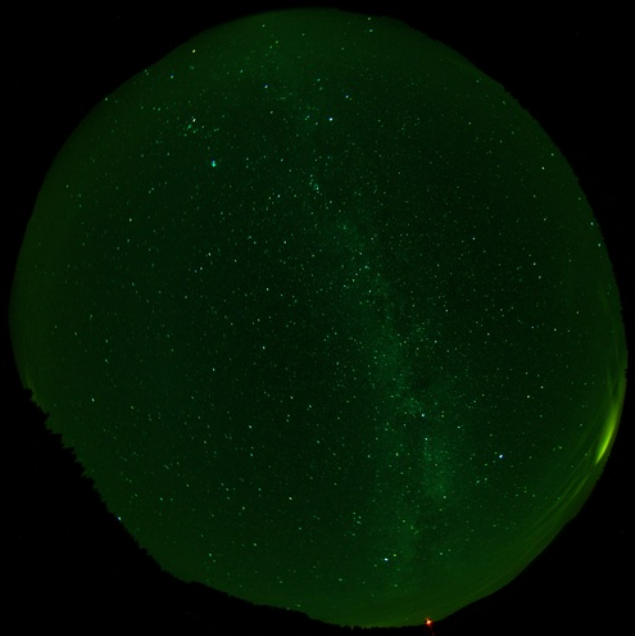
- Sky Quality Meter SQM

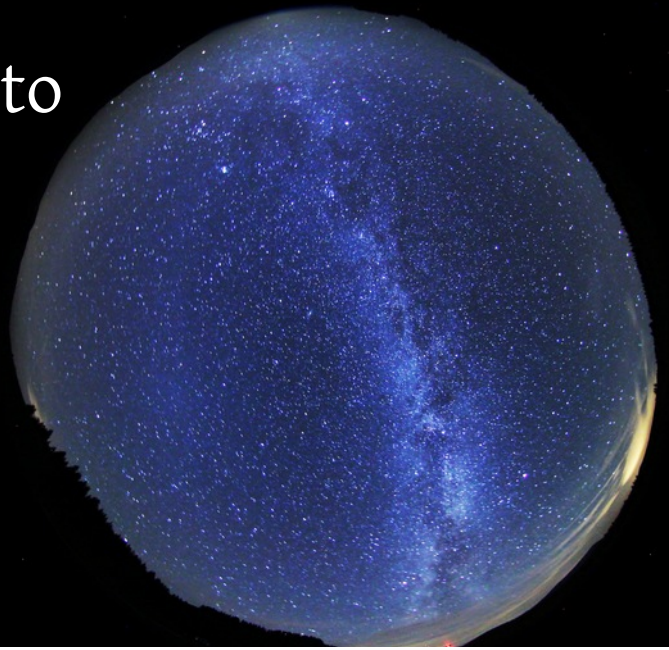
- DSLR photometry

Digital camera photometry to test sky quality

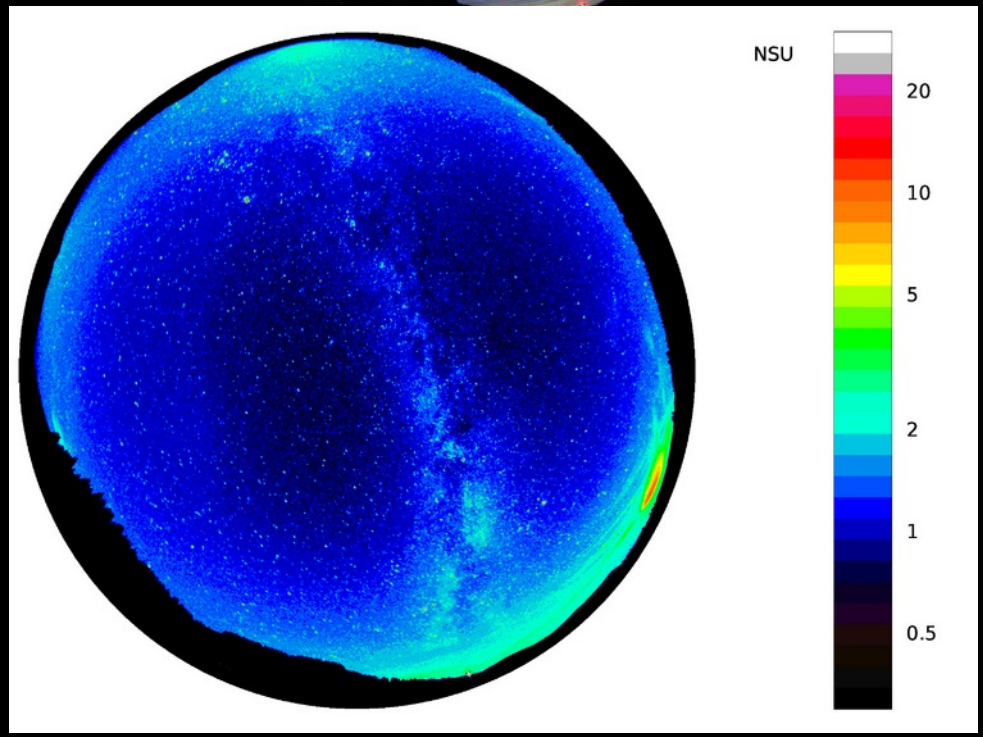
Processed photo

Raw (linear) image





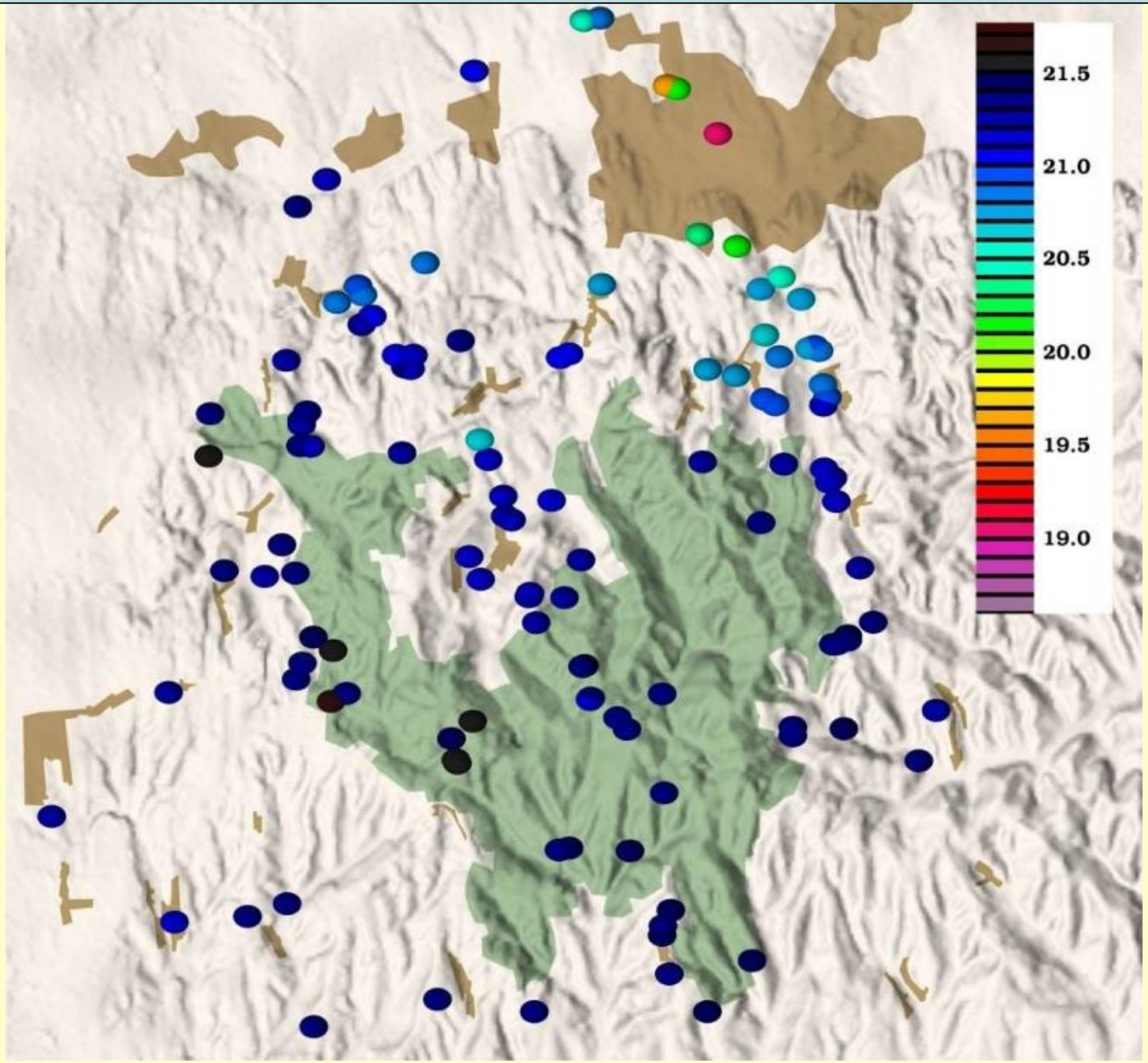
Calibrated
radiance map



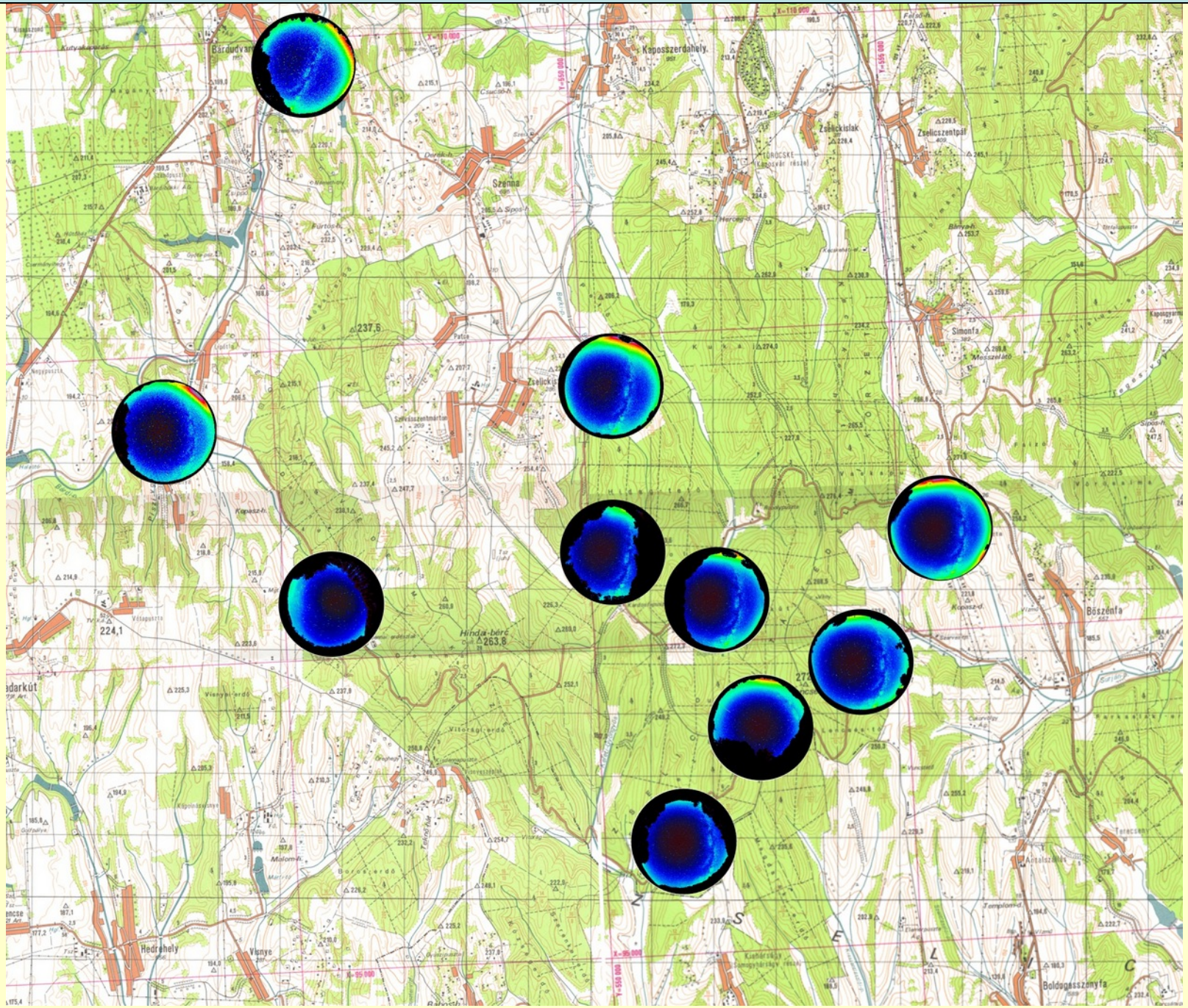
Main steps of preparation of establishment the starry sky park

- Light pollution measurements and mapping
- Lighting inventory
- Management plan
- Lighting regulation (Lightscape Management Plan)
- Pilot lighting projects
- Awareness programs (website, leaflet, tourist-map, night time walks, astronomical programs)

2007 – SQM measurements

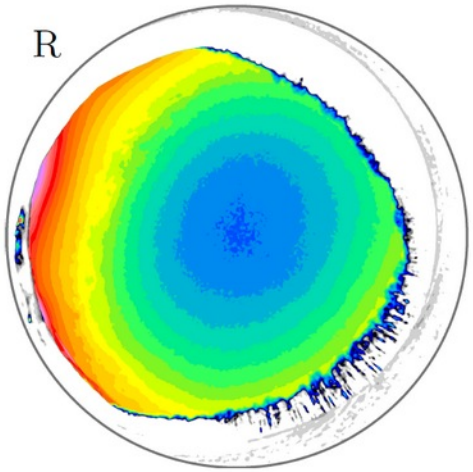


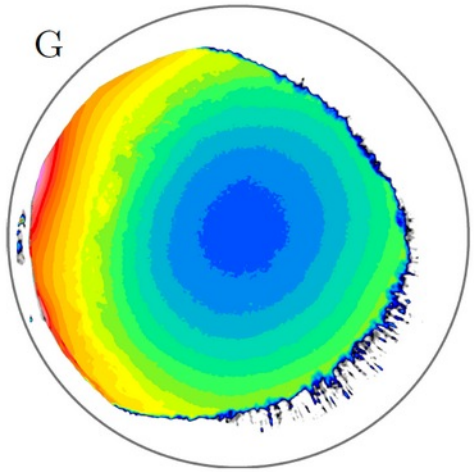
2008 DSLR photometry

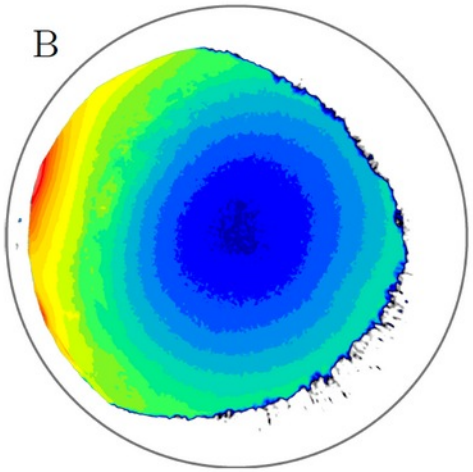


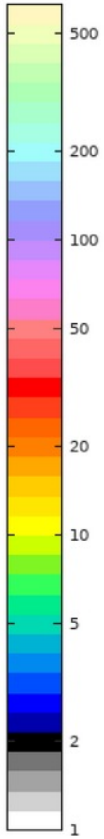
A new recommended metric and unit

Bükk Starry Sky park









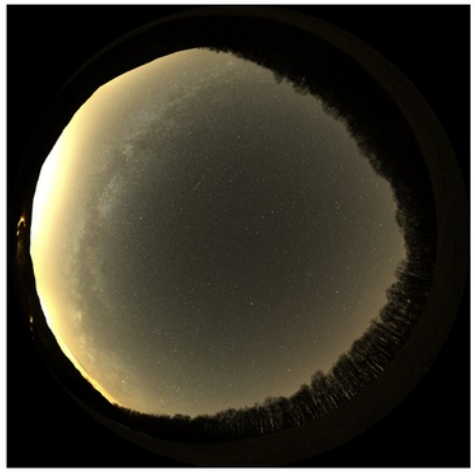
	R	G (mpsas)	B
z<5°	3.4	3.2 (21.7)	2.5
z<15°	3.6	3.3 (21.6)	2.6
z<30°	3.9	3.7 (21.5)	2.9
min	3.4	3.1 (21.7)	2.4
max	66.2	31.2 (18.6)	31.2

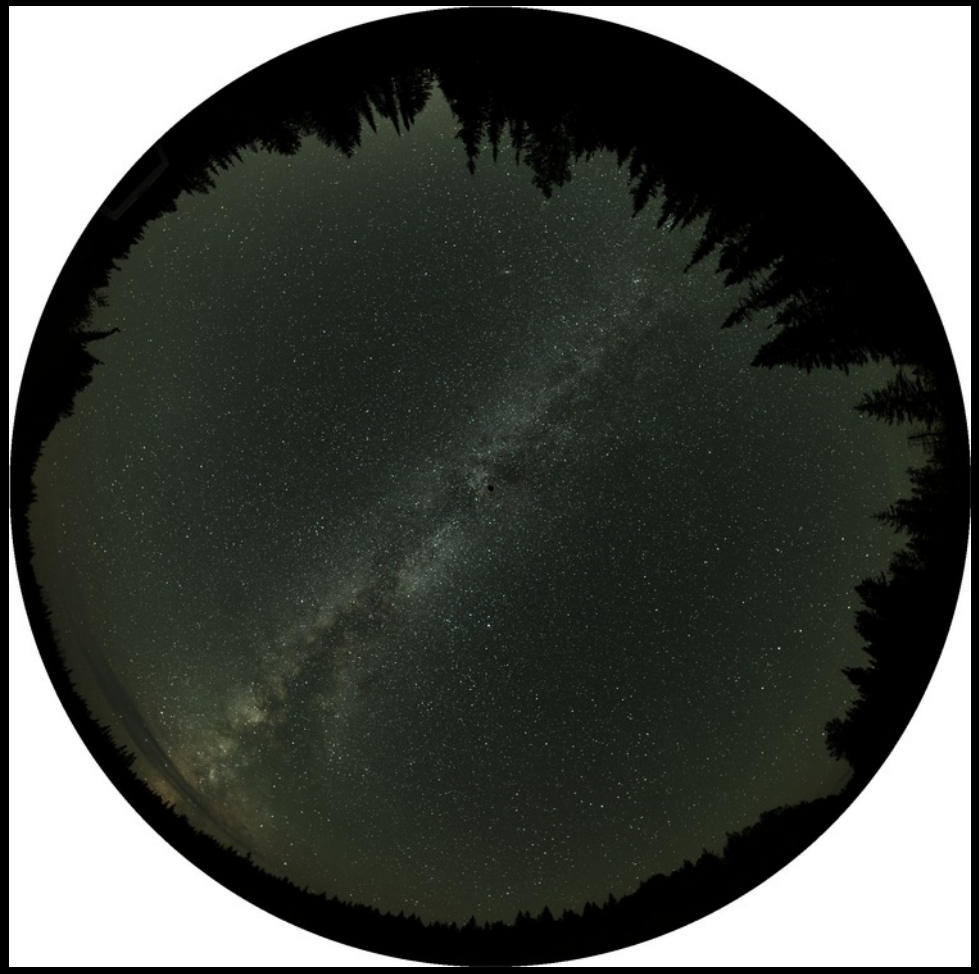
Units given in $nW/m^2/sr/nm$ (and mpsas for G)

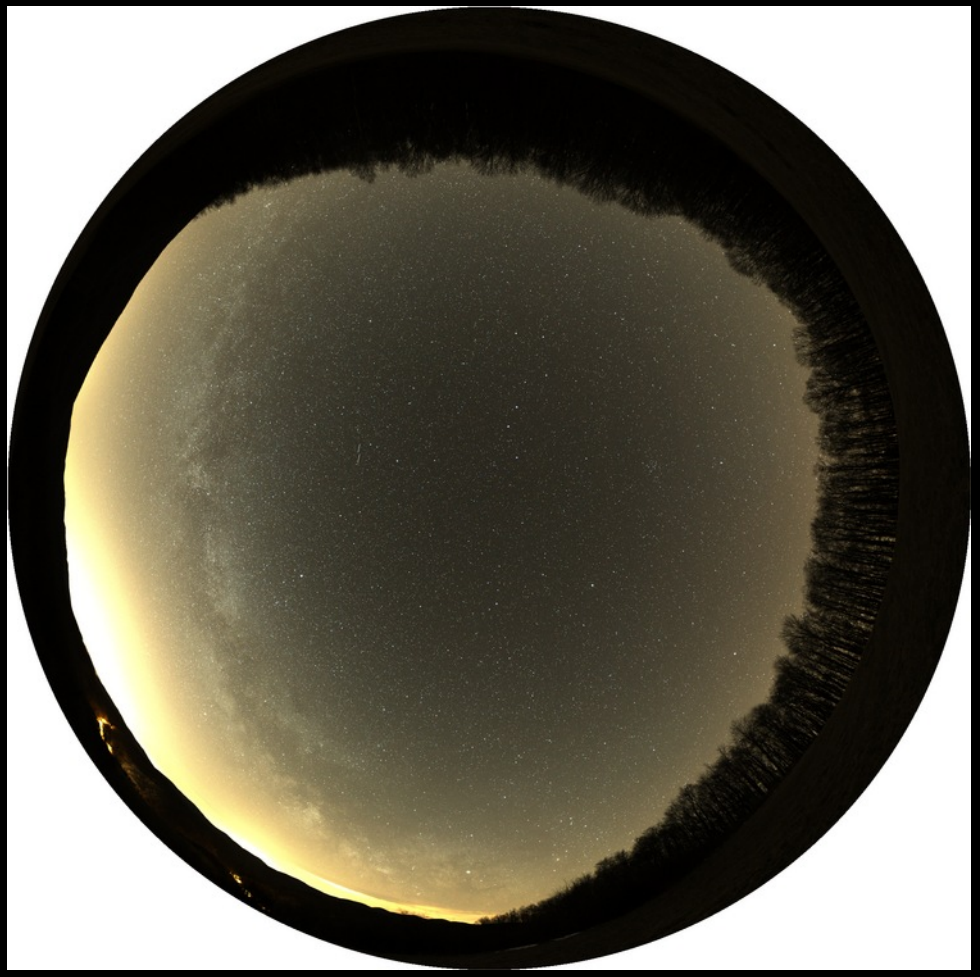
Observers: Zoltán Kolláth, Richárd Novák & József Vanyó

Date: March 05/06 2019

Coordinates: 48.052560 20.511750



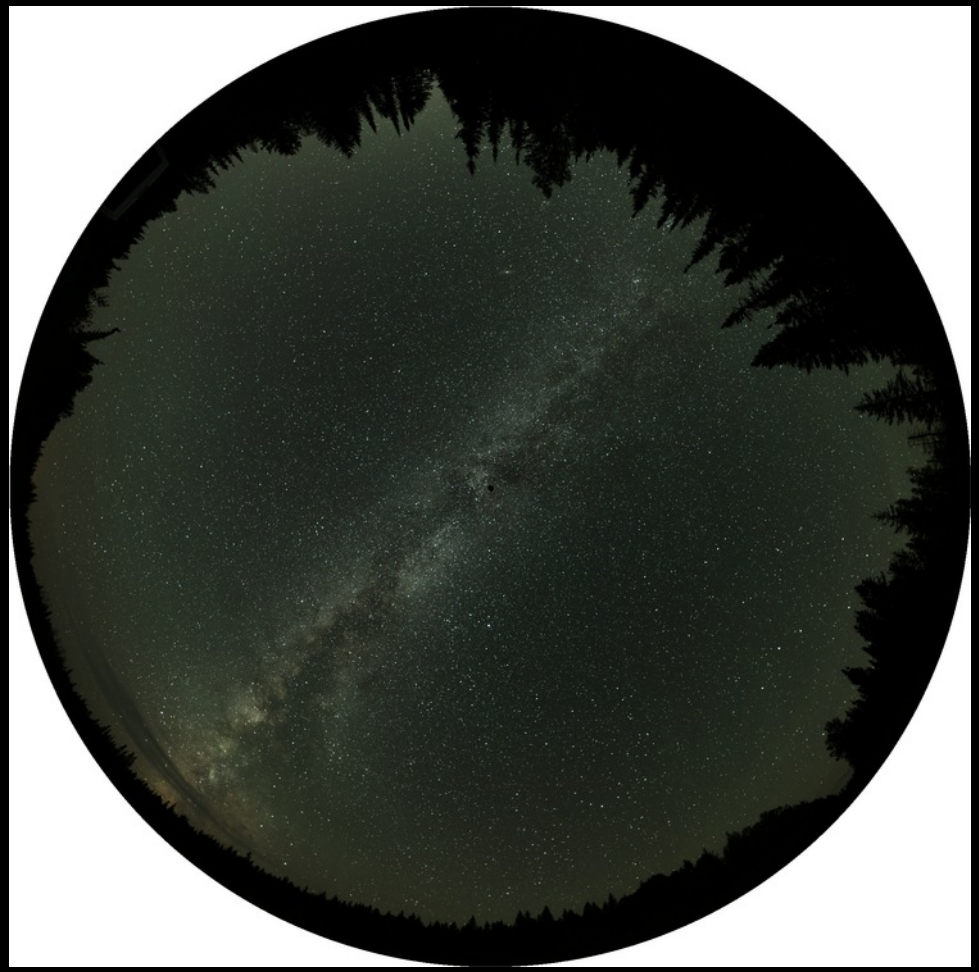




No light pollution

Best places in Hungary

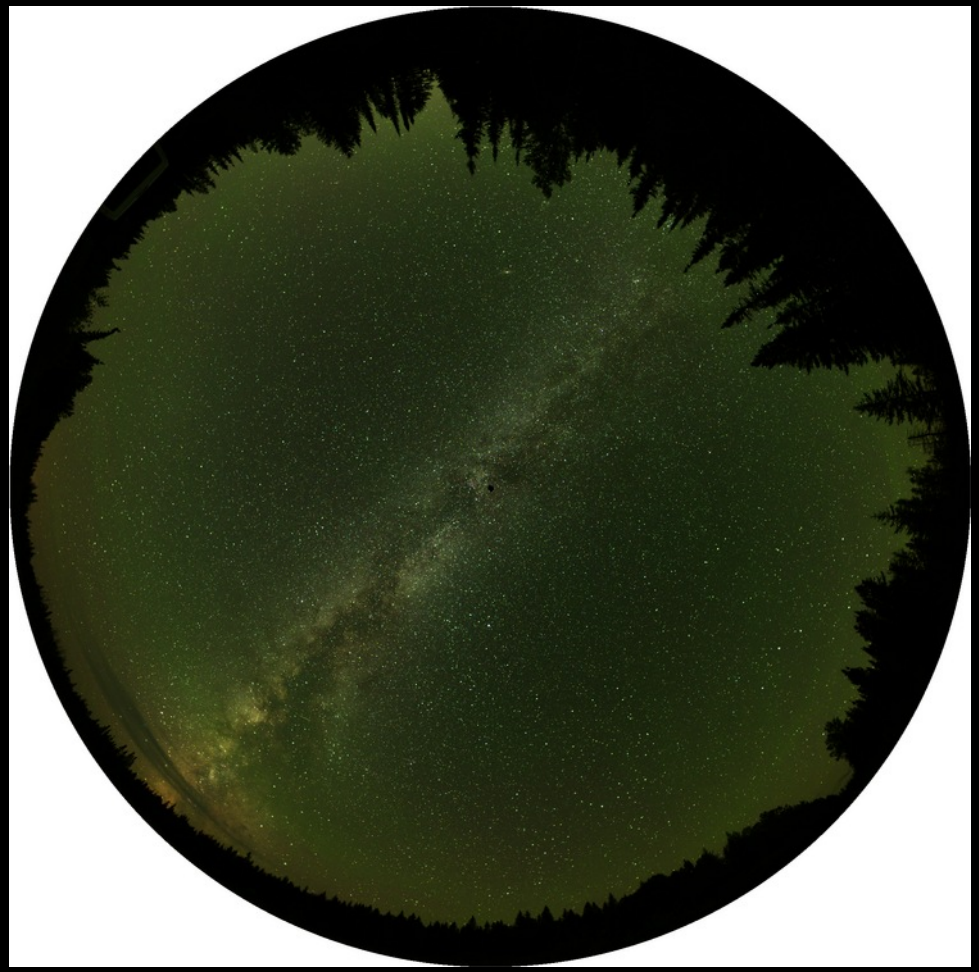
With the same processing

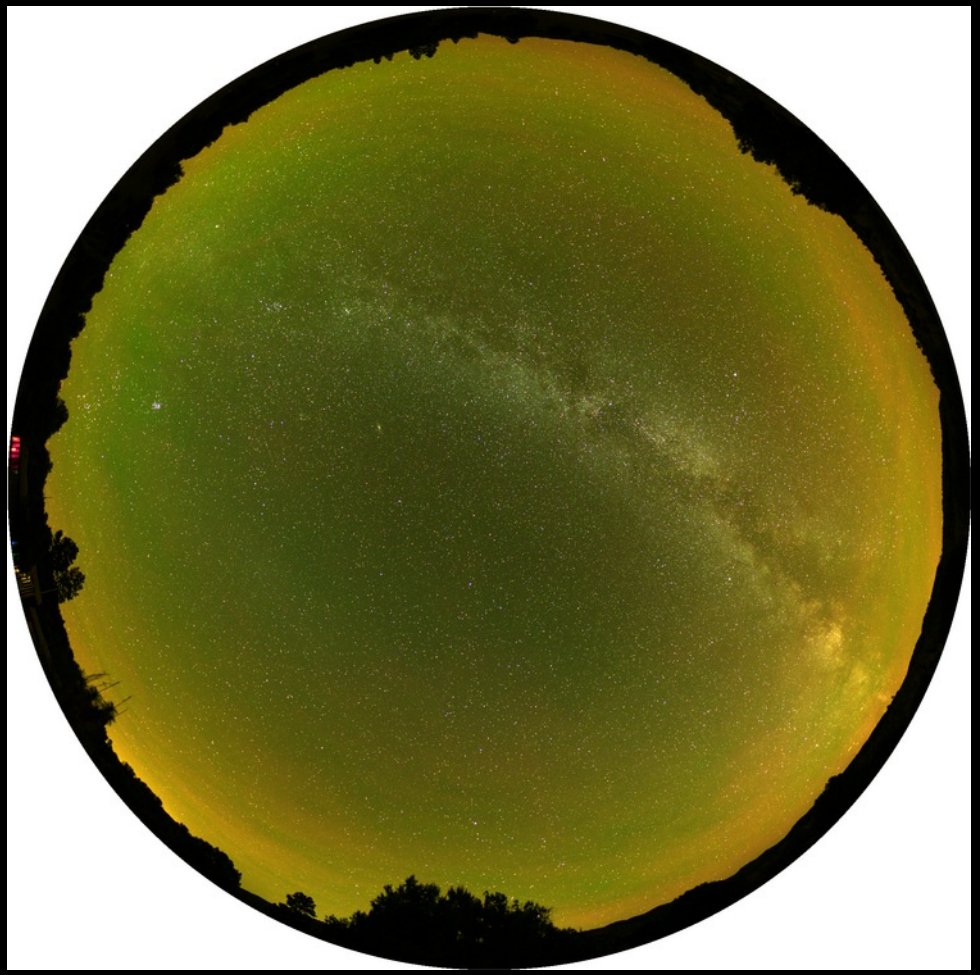


Low airglow level

High airglow (O and NA)

With the same processing





Low airglow level

High airglow (O and NA)

With the same processing


Thank you for your attention!