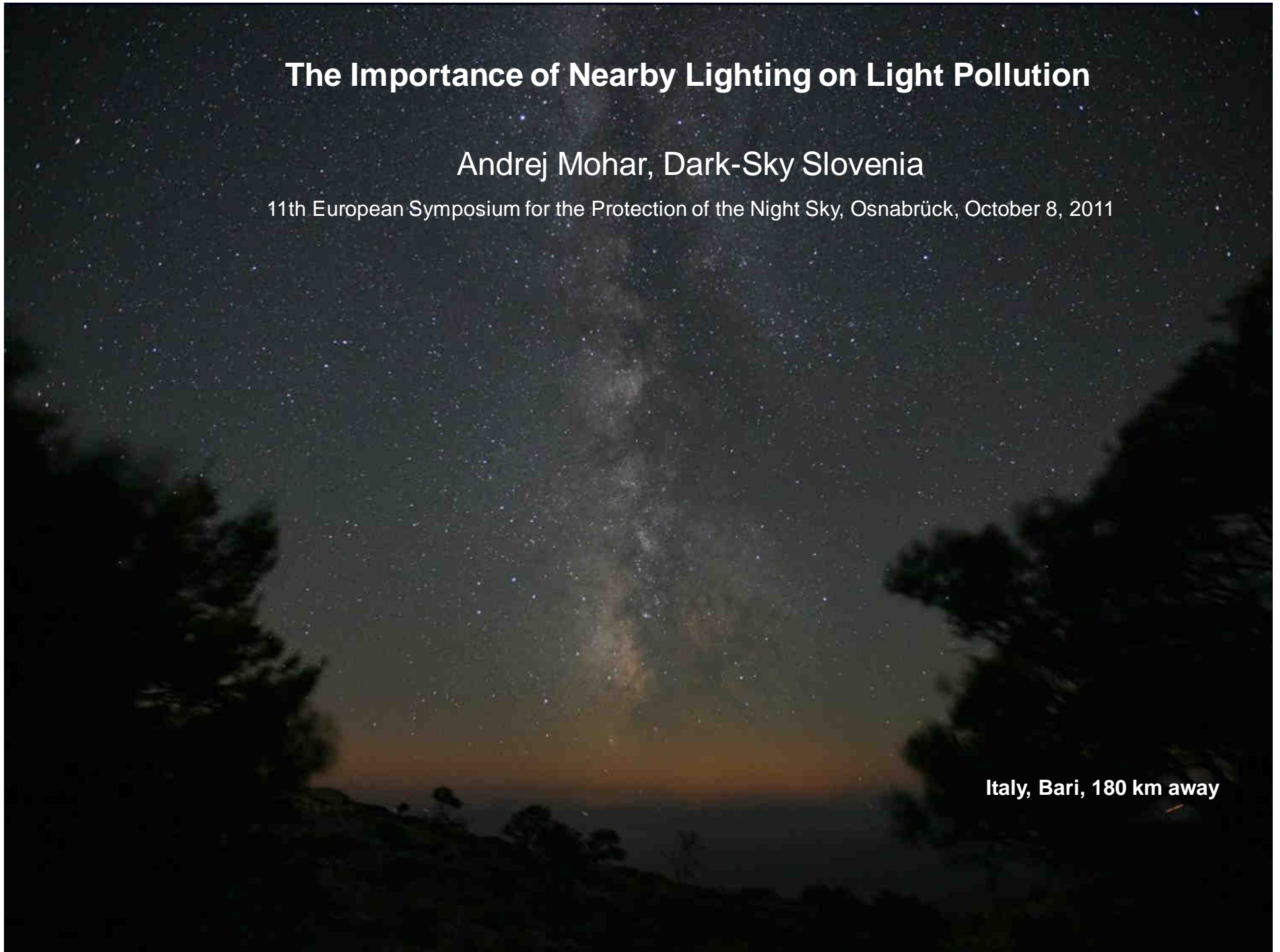


# **The Importance of Nearby Lighting on Light Pollution**

Andrej Mohar, Dark-Sky Slovenia

11th European Symposium for the Protection of the Night Sky, Osnabrück, October 8, 2011

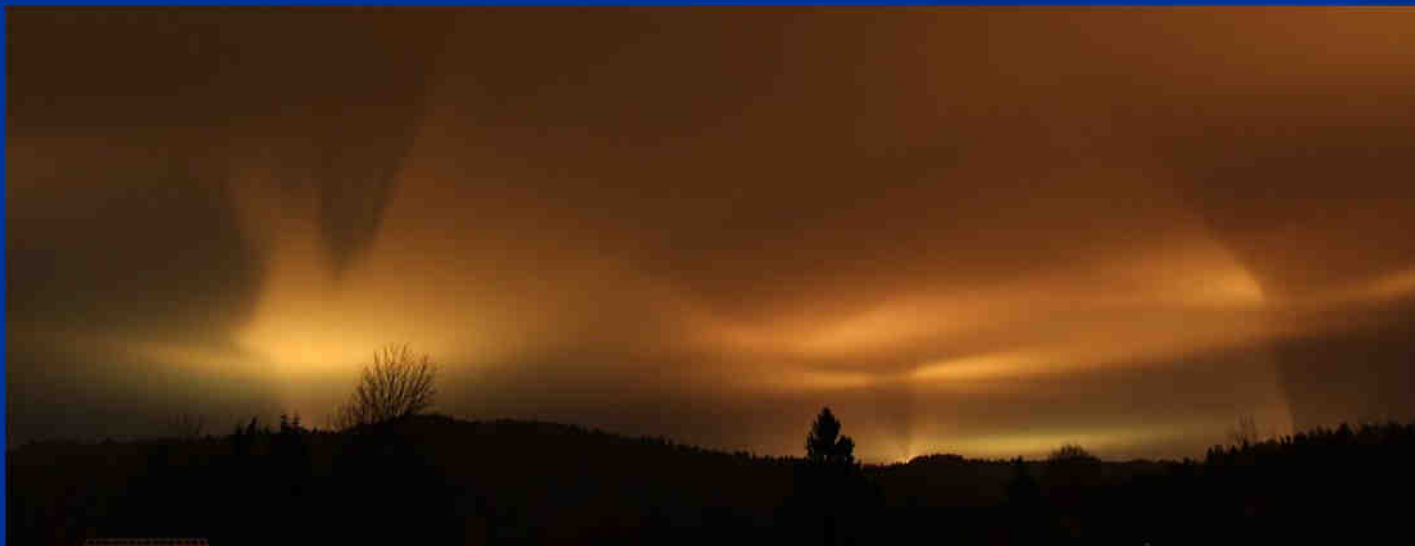
Italy, Bari, 180 km away



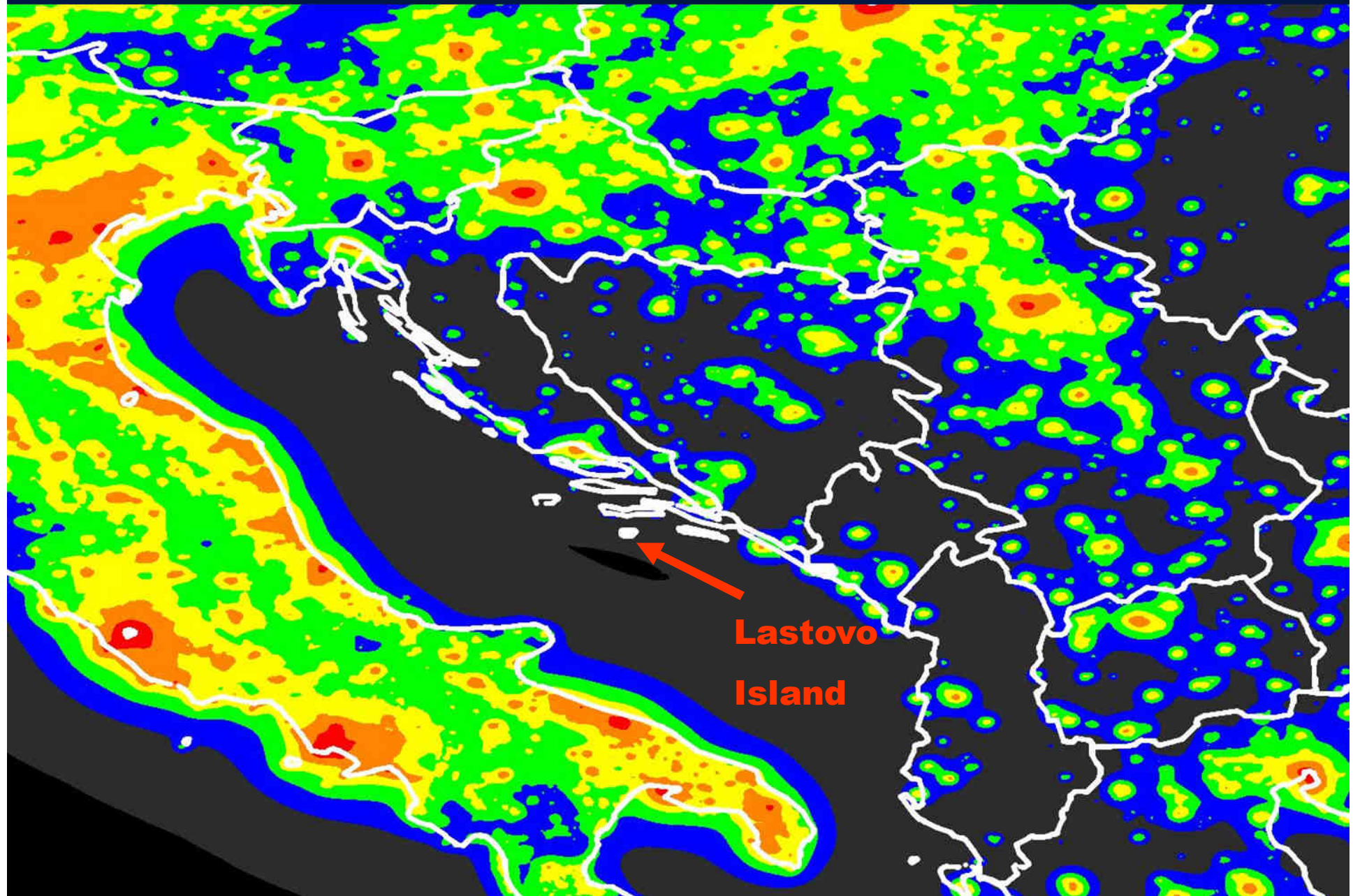
## The Importance of Nearby Lighting on Light Pollution



Just 1 % of lumen output (ULOR 1 %) very close to horizon could double light pollution at larger distances (in case of clear sky)



## The Importance of Nearby Lighting on Light Pollution





## The Importance of Nearby Lighting on Light Pollution



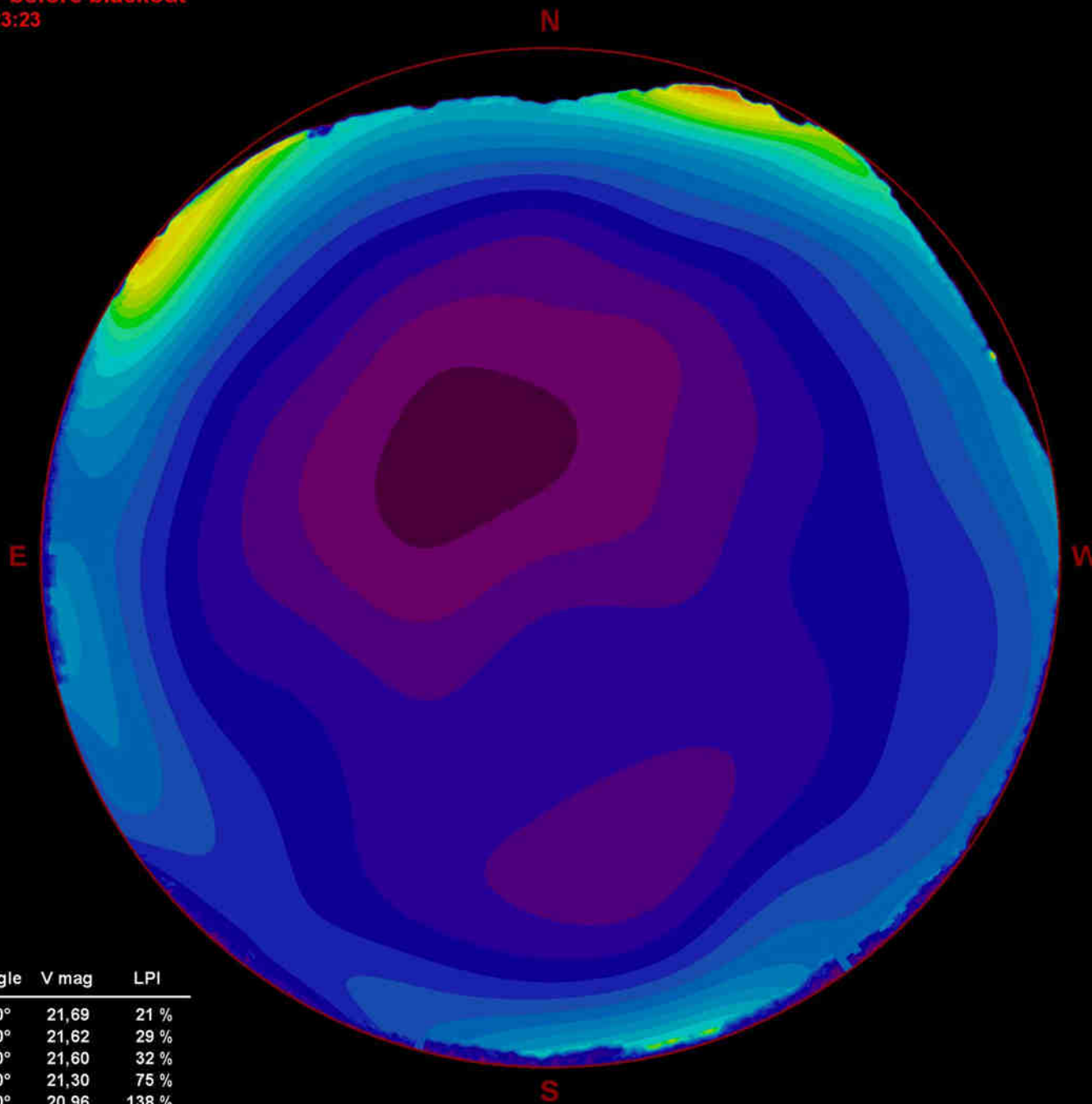
Distances:

Pasadur 3,6 km, Ubli 2.5 km, Lastovo 4 km Skrivena luka 2.8 km

Observing place 300 m – 400 m higher than luminaires

Lastovo - before blackout  
1.2.2011 23:23

mag/arc-sec<sup>2</sup>



- > 22,21
- 22,11 - 22,20
- 22,01 - 22,10
- 21,91 - 22,00
- 21,81 - 21,90
- 21,71 - 21,80
- 21,61 - 21,70
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- 17,71 - 17,80
- < 17,70

Zenith Angle	V mag	LPI
0° - 30°	21,69	21 %
0° - 60°	21,62	29 %
30° - 60°	21,60	32 %
60° - 80°	21,30	75 %
80° - 90°	20,96	138 %

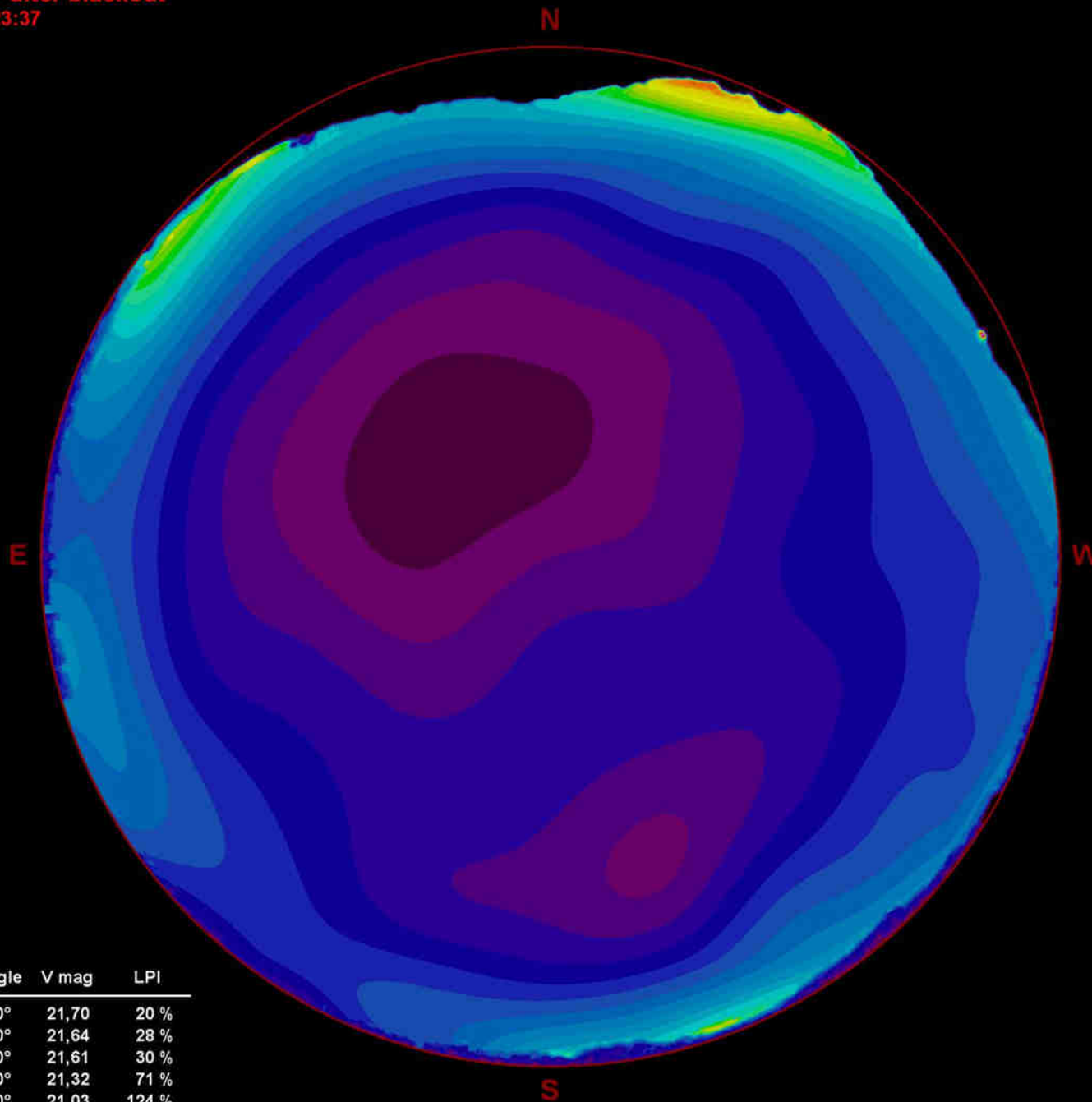
Blackout of all public lighting of  
Lastovo island

Distance to Lastovo  
village is 4 km



Lastovo - after blackout  
1.2.2011 23:37

mag/arc-sec<sup>2</sup>



- > 22,21
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- 17,71 - 17,80
- < 17,70

Zenith Angle	V mag	LPI
0° - 30°	21,70	20 %
0° - 60°	21,64	28 %
30° - 60°	21,61	30 %
60° - 80°	21,32	71 %
80° - 90°	21,03	124 %



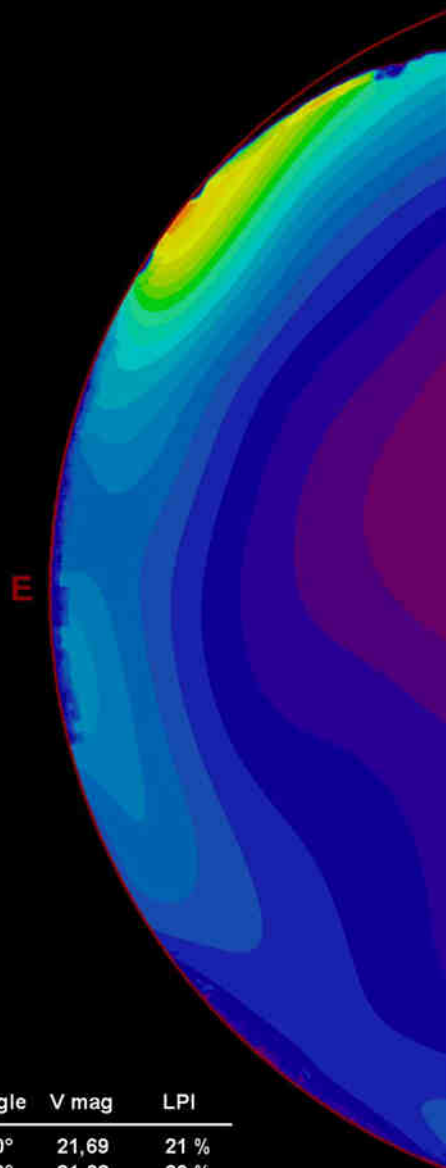
## Measuring conditions:

- almost natural dark place
- Canon 5D (standard procedure), high linearity
- blackout at 00:30, february 2011
- time difference between measurements was 10 min
- low temperature + low humidity (+6C)
- high temperature + high humidity test failed due to clouds in September 2011



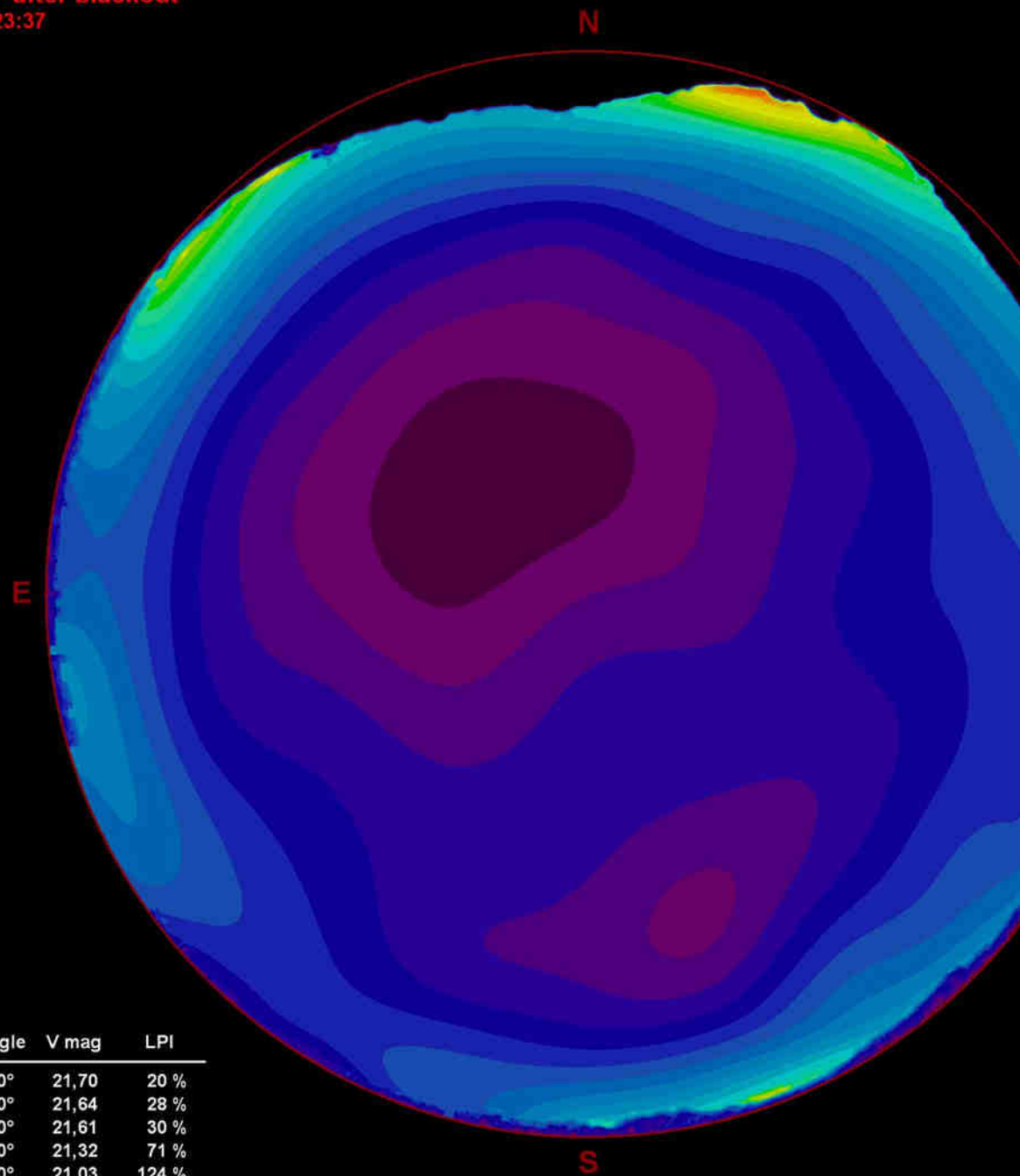


Lastovo - before blackout  
1.2.2011 23:23



Zenith Angle	V mag	LPI
0° - 30°	21,69	21 %
0° - 60°	21,62	29 %
30° - 60°	21,60	32 %
60° - 80°	21,30	75 %
80° - 90°	20,96	138 %

Lastovo - after blackout  
1.2.2011 23:37



Zenith Angle	V mag	LPI
0° - 30°	21,70	20 %
0° - 60°	21,64	28 %
30° - 60°	21,61	30 %
60° - 80°	21,32	71 %
80° - 90°	21,03	124 %

## Before blackout

Difference (V mag)

## After blackout

Zenith Angle	V mag	LPI
0° - 30°	21,69	21 %
0° - 60°	21,62	29 %
30° - 60°	21,60	32 %
60° - 80°	21,30	75 %
80° - 90°	20,96	138 %

+0.01 m

+0.02 m

+0.02 m

+0.07 m

Zenith Angle	V mag	LPI
0° - 30°	21,70	20 %
0° - 60°	21,64	28 %
30° - 60°	21,61	30 %
60° - 80°	21,32	71 %
80° - 90°	21,03	124 %

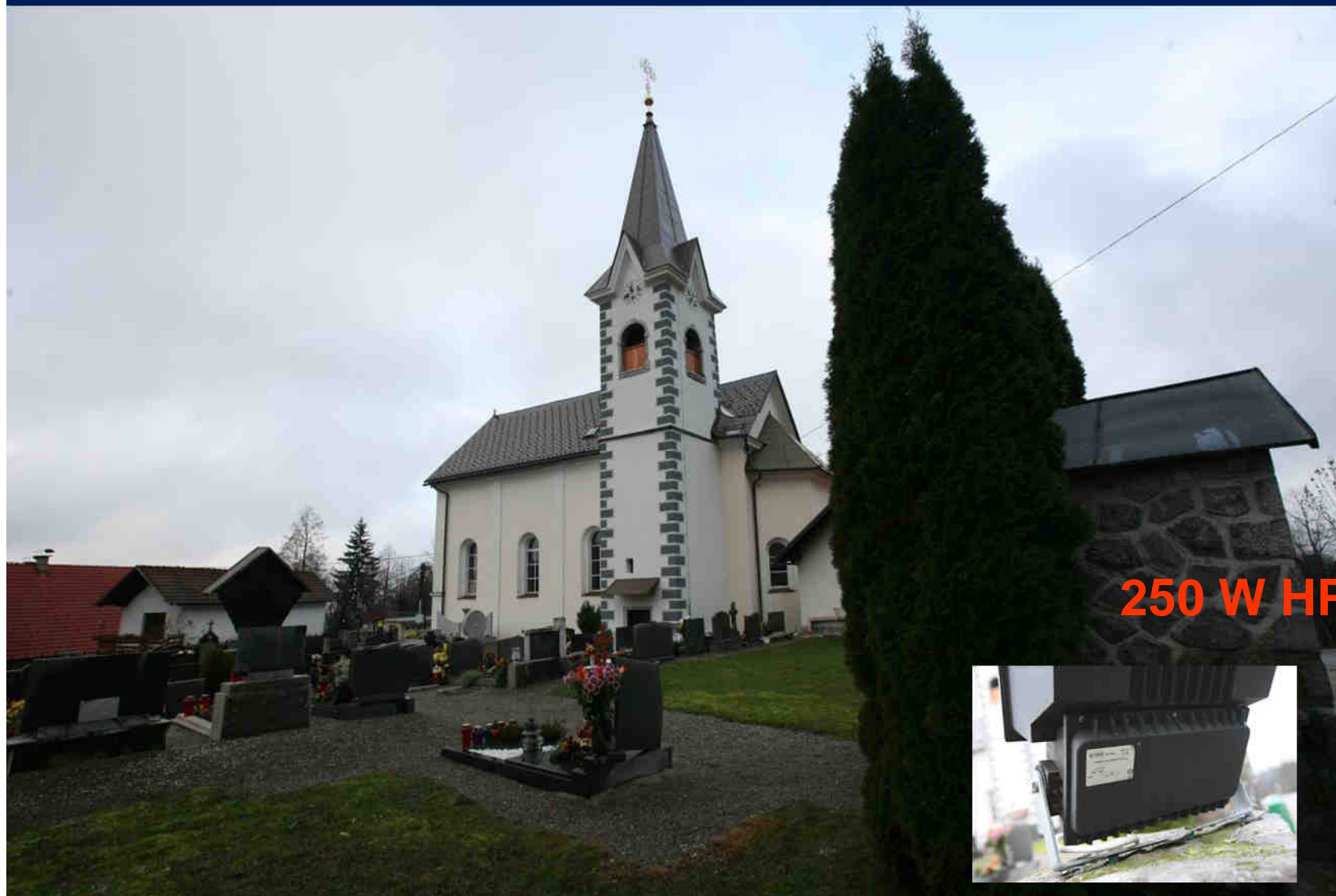
**Lastovo Island will in this month (October 2011) change ALL public lighting into:**

1. Fully shielded 0 % ULOR luminaires (Phillips)
2. Most of luminaires will have 70 W high pressure sodium bulbs (with dimmers)
3. Just 4 luminaires will be MH – for the football place (temporary in use)

**This is project in Croatia will be realized because of**

**constant and strong pressure by Dark-Sky Slovenia !!!**

## Zaplana Astronomical Observatory – 1.7 km from illuminated church





Zaplana  
11.12.2010 21:50

## Zaplana Astronomical Observatory –

HPS 250W floodlight (church illumination) directed  
horizontally into observatory

mag/arc-sec<sup>2</sup>



Zenith Angle	V mag	LPI
0° - 30°	20,60	232 %
0° - 60°	20,44	284 %
30° - 60°	20,39	302 %
60° - 80°	19,86	552 %
80° - 90°	NaN	NaN %

Zaplaná  
11.12.2010 22:06

# Zaplaná Astronomical Observatory –

HPS 250W switched off

zenith (0-30 deg)  
is 0.05 mag darker

mag/arc-sec<sup>2</sup>

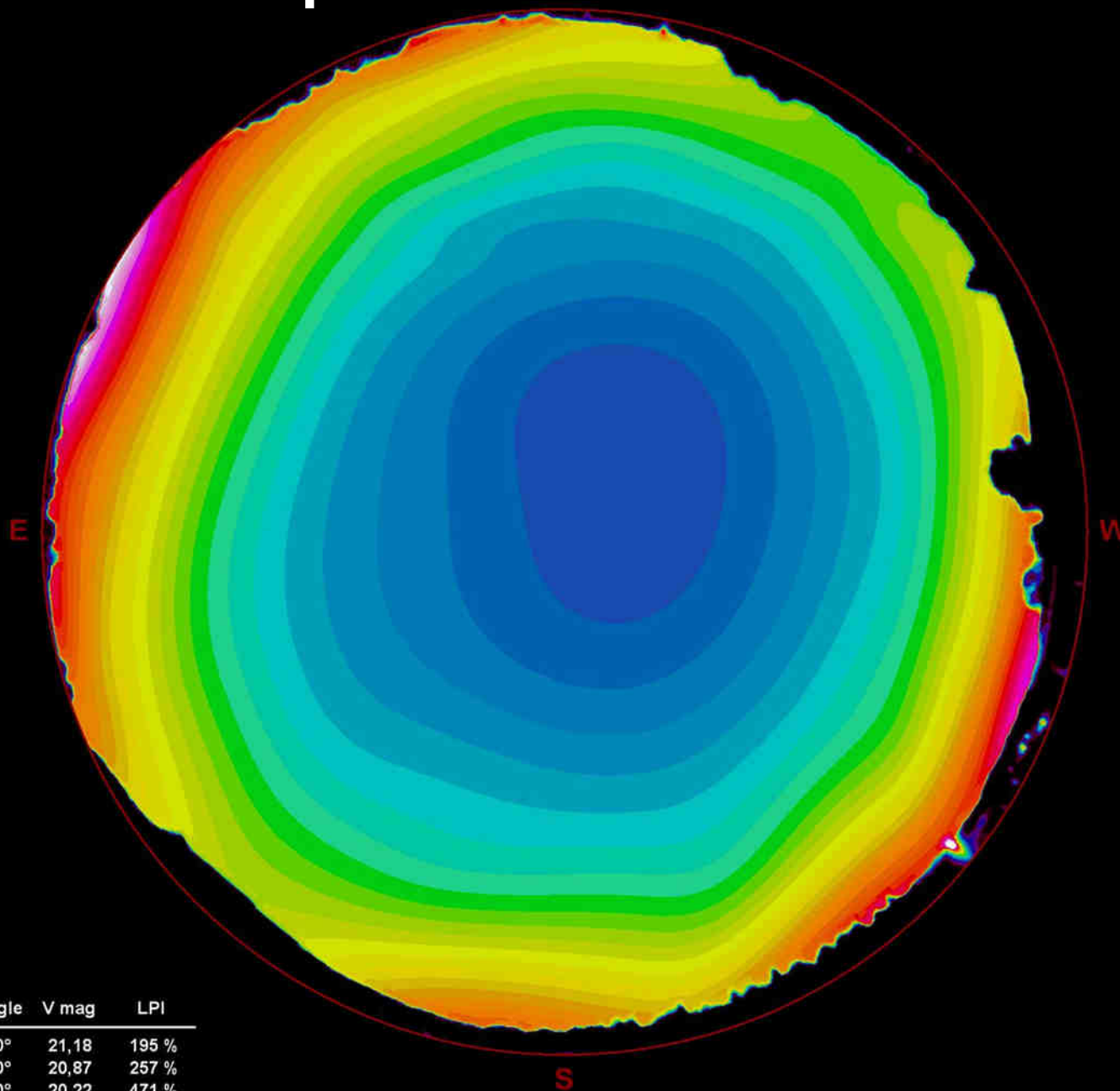


Zenith Angle	V mag	LPI
0° - 30°	20,64	218 %
0° - 60°	20,49	265 %
30° - 60°	20,44	282 %
60° - 80°	19,91	524 %
80° - 90°	NaN	NaN %

Zaplana 19. 7. 2009

# Zaplana – without snow

mag/arc-sec<sup>2</sup>



Zenith Angle	V mag	LPI
0° - 30°	21,18	195 %
30° - 60°	20,87	257 %
60° - 80°	20,22	471 %

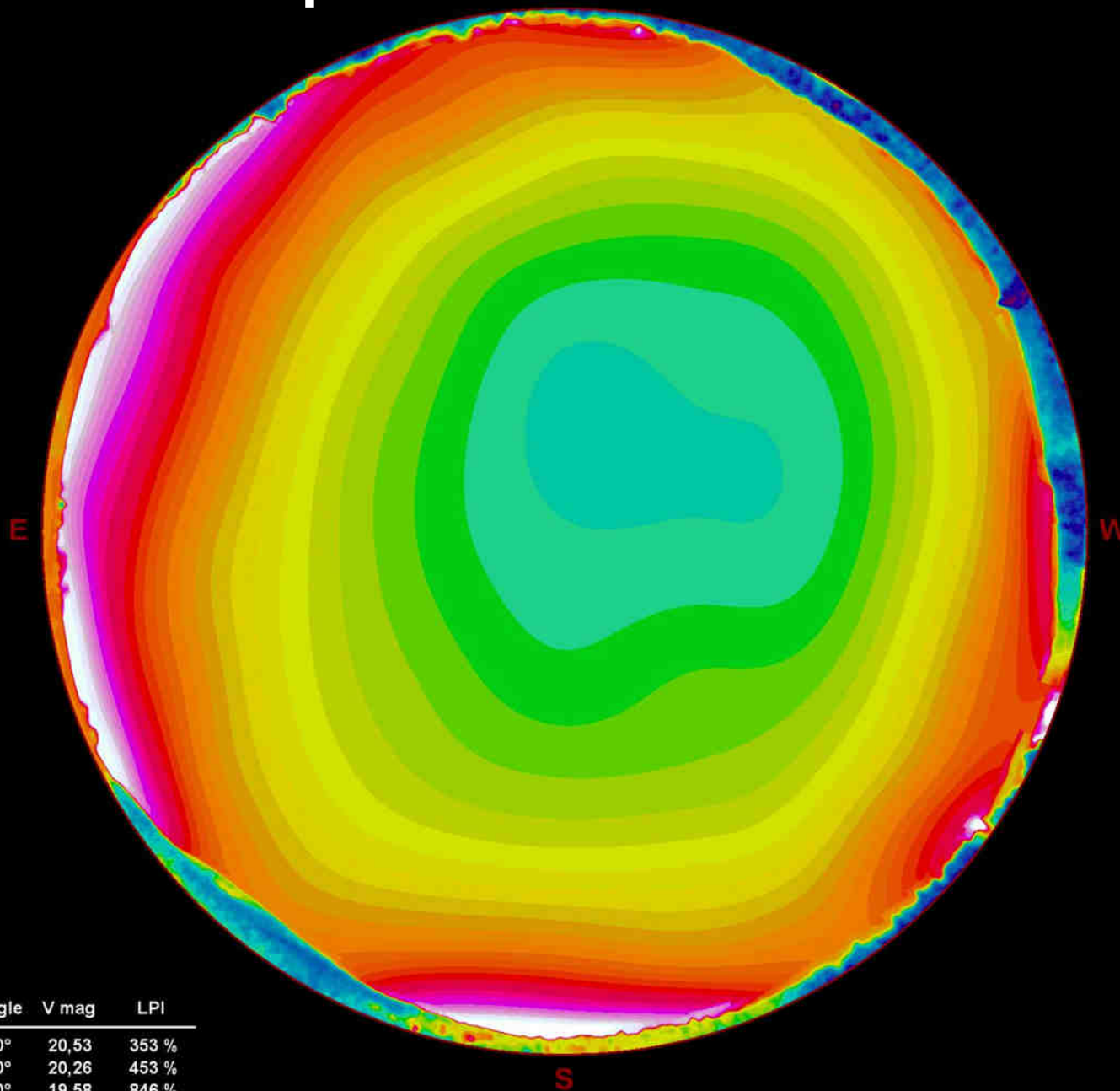
> 22,21  
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17,91 - 18,00  
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17,71 - 17,80  
< 17,70



Zaplana 20. 12. 2009

# Zaplana – with fresh snow

mag/arc-sec<sup>2</sup>



Zenith Angle	V mag	LPI
0° - 30°	20,53	353 %
30° - 60°	20,26	453 %
60° - 80°	19,58	846 %

> 22,21  
22,11 - 22,20  
22,01 - 22,10  
21,91 - 22,00  
21,81 - 21,90  
21,71 - 21,80  
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## The Importance of Nearby Lighting on Light Pollution

### Conclusions:

	difference
Lastovo blackout – all (bad) lights off in range from 2 km– 4 km	<b>0.01 mag</b>
Zaplana – 1 x 250W HPS directly pointed to observer from 1.7 km	<b>0.05 mag</b>
Zaplana – fresh snow / without snow	<b>0.65 mag</b>

**Nearby lighting has almost no effect on clear sky brightness.**

If we switch all lighting at Lastovo we get 0.01 magnitude darker sky.

The rest of light pollution (0.1 – 0.2 magnitude) comes from 60 – 90 km (coast) and up to 200 km (Italy).

**If we want to get natural dark sky in dark sky parks we need to have 0 % ULOR in all cities !!!**

## Light pollution at Lastovo island, Croatia



**Light pollution from Bari, Italy, 180 km far away**

When clouds cover Italy, light pollution decreases about 80 % (from 20% above natural sky level to 5 % above natural sky level)

**Conclusion: Local lighting is not very important, the most important are light sources from big cities - even if they are 180 km away!**