

**Intercomparison of Light Pollution Measuring Techniques  
COST Action ES1204**

# **Abstracts**

**Status: August 30- September 08, 2013**

**What can we learn from time-lapse photography/photometry (30 min)**

**Zoltán Kolláth**

Time-lapse photography is a great tool to present the beauty of the night sky for the general audience. In addition it gives lots of information about the events and quality of the nocturnal sky. I give a brief introduction of the methods and instruments used for time-lapse photography. Sequences of images have been used in astronomy for a long time: it provides the basics of photometry as well. I will talk about the fundamentals of astronomical photometry, how an important quantity of Earth's atmosphere, the extinction can be determined, and how all this measurements are connected to the quality of night sky and light pollution.

**Night sky photometry and night sky spectroscopy  
performed at the Vienna University Observatory (30 min)**

**Thomas Posch**

I shall present night sky brightness measurements performed at the Vienna University Observatory and at the Leopold-Figl-Observatorium für Astrophysik, which is located about 35km to the southwest of Vienna. The measurements have been performed with Sky Quality Meters made by Unihedron. They cover a time span of more than one year and have been carried out every night, yielding a night sky brightness value every 7 seconds and thus delivering a large amount of data. In my talk, the level of light pollution in Vienna, which ranges from 15 to 19.25 mag/arcsec<sup>2</sup> is presented for the very first time in a systematic way. I'll discuss the influence of different environmental conditions on the night sky brightness and implications for human vision. I'll show that the circalunar rhythm of night sky brightness is extinguished at our observatory due to light pollution.

Additionally, I'll present spectra of the night sky in Vienna, taken with a 0.8m telescope. The goal of these spectroscopic measurements was to identify the main types of light sources and the spectral lines which cause the light pollution in Vienna. It turned out that fluorescent lamps are responsible for the strongest lines of the night sky above Vienna (e.g. lines at 546 nm and at 611 nm).

## **Light Pollution in Italy (25 min)**

**Fabio Falchi, Andrea Giacomelli, Cielo Buio Italy**

The talk will provide insights on various aspects of light pollution in Italy, with a review of current status of legislation, analysis of LP trends in selected sites, and hints to some of the actions to raise awareness and counter LP. General indications for mitigation of light pollution issues will also be provided.

## **Measuring Light Pollution in Montsec: a protected area (30 min)**

**Salvador J. Ribas, Parc Astronòmic Montsec**

Montsec Mountains are a special protected place in Catalonia (NE of Iberian Peninsula). Since mid-90's, this area was selected for amateur astronomers to install their astronomical observatories. In 2002 the Government of Catalonia started the project Parc Astronòmic Montsec with the aim to have two astronomical installations: one for research and the other for outreach and education. Dark skies are probably the most valuable thing in Montsec and for this reason this area is specially protected by Catalan Laws. In 2012, Parc Astronomic Montsec and the official Catalan Service against Light Pollution have developed a measurement plan using different kind of data. The results of this study showed Montsec is one of the best places in Southern Europe with typical sky brightness better than 21.0 and in some places between 21.5 and 22.0.

## **Sky Quality Camera (30 min)**

**Andrej Mohar, Alen Jakovac, Euromix Ltd.**

Sky Quality Camera (SQC) is based on digital DSLR camera with fisheye lens. Latest digital cameras like Canon EOS 5D, 6D, 700D provides 2-dimensional images of light pollution. Sophisticated software is necessary to eliminate effects of Milky way and Zodiacal light. Results. Light pollution measurements based on Sky Quality Camera are much more accurate and provide more information than single poin measurements.

## **Time Lapse Imaging on Light Pollution (20 min)**

**Till Credner**

Doing single measurements on the sky brightness does not give representative values. Variations in time and direction at the sky are strong. Many examples of time lapse imaging show this very well. Simultaneous all-sky imaging and data logging SQM measurements on Lastovo should help in calibrating camera data.

## **The power of city-light-domes (25 min)**

**G.Wuchterl Kuffner-Sternwarte and Thueringer Landessternwarte Tautenbourg**

We present measurements of the downward energy flux density (total radiation) and calculations of the total power output of city light domes using the IYA Lightmeter, [lightmeter.astronomy2009.at](http://lightmeter.astronomy2009.at). The Lightmeter is calibrated to the total radiation of the Sun, the Moon, the twilight and the natural night sky. Thus we can measure the "night light energy" much like the "solar energy" is measured during the day. The lightmeter also offers a natural continuation of measurements of total radiation that are routinely taken during the day for climate, meteo and environmental research. Methods for cloud recognition can also be used following the daylight procedures because of the high sensitivity of the lightmeter.

As an example we present the measurements taken with our network in and around the city of Vienna. Results are shown for the total energy radiated from the night sky onto the ground and the electric power required to sustain this "waste-light". Annual and monthly medians are discussed for all night-sky and weather conditions with a > 95% duty cycle at 1Hz.

New seasonal effects are described for 2012 and a good weather median of about 30 Megawatt for the waste-light of Vienna is found. Peak values up to 100 MW are obtained under some weather conditions and a strong rise early in winter is seen. Less than 30% of the light dome is caused by public street lights.

## **Faint Phenomena of Natural Night Sky (20 min)**

**Jernej Širok, Dark-Sky Slovenia**

The natural moonless night sky, free of artificial light, offers many faint phenomena, which tend to wash out under city and rural skies. The splendourous Milky Way with all its patches of dust and gas and bright milky areas, densely populated by hundreds of thousands of stars, the morning and evening Zodiacal light and Gegenschein, both a result of sunlight, scattering from the particles of interplanetary dust, auroras, sky glow and faint tails of comets can all be observed with naked eye if the sky is naturally dark. And while looking away from the sky, you can see your shadow from the light of Milky Way or observe the reflection of celestial objects on calm water surfaces.

## **Starlight and World Heritage (25 min)**

**Günther Wuchterl Kuffner-Sternwarte and Thueringer Landessternwarte Tautenbourg**

The IAU UNESCO initiative on astronomy and world heritage continues towards the first "starlight" world heritage sites. Five "extended case studies" of starlight sites have been prepared by the IAU and were adopted by the 2012 general assembly of the International Astronomical Union. These scientific preparation and documentation for official world heritage proposals, so called "dossiers" is available via the new IAU/UNESCO portal

<http://www2.astronomicalheritage.net/> It will help the nations to prepare their world heritage nominations.

The "outstanding universal value" that is necessary for world heritage sites is explained and concepts are presented of how to include astronomical sites (starlight reserves, dark sky parks, starlight tourist destination, etc.) into the framework of the UNESCO world heritage convention.

The following concepts are introduced and described:

- + quantification of the "perfect sky" for a starlight world heritage site,
- + sky-landscape-systems,
- + regional skies,
- + cultural skies,
- + epoch skies,
- + the night sky as fact basis for science-epochs.

These concepts are then applied to the "extended case studies" for 3 "windows to the universe" (Mauna Kea, Canary Islands Observatories, Cerro Tololo), the New-Zealand - Aoraki-Mout Cook Starlight Reserve and the Eastern Alpine Starlight Reserve with the Grossmugl starlight Oasis.

### **Light Pollution in an island state – the situation in the Maltese islands (25 min)**

**Alexei Pace**

Islands present particular problems and opportunities in the fight against light pollution. The Maltese islands consist in a small, but densely-populated archipelago of islands. Active campaigns against light pollution have been going on since 2000, with environmental NGOs joining and with varying degrees of success.

### **Light pollution in western Slovenia (15 min)** **Primož Kuk, Astronomical Society Telescope, Dark-Sky Slovenia**

Western part of Slovenia is one of the most heavily light polluted area in Slovenia. We get a lot of light pollution from nearby Italy. The largest polluters will be presented and our activities to stop and reduce light pollution.

### **State of light pollution in Kraljevo (15 min)** **Vladimir Došović**

Kraljevo is like every city in Europe, many lights, many roadways and many other things that make the problem of astronomical observations. Therefore we were forced to carry out our observations on the mountain Goc(1216m), which is on half an hour from Kraljevo. Everything

was great until the last couple of years when Goc started to rapidly urbanizing. Then began our fight against light pollution in Kraljevo.

### **Using light for mapping the aerosols (15 min)**

**Milesa Blagojević**

Polarization is a phenomenon which could occur as a consequence of either refraction or scattering of light. When a light that comes from the Sun enters the atmosphere it is scattered on the air particles and gets polarized due to that scattering and does so depending on the angle of scattering and the dimensions of a particle. That is why we can determine the size and therefore origin of a particle by examination of light beam that it scattered. The Earth's atmosphere itself is composed of small particles and all the bigger ones are the aerosols or water (clouds for example). Light pollution though does not get polarized.

### **Light pollution in city Belgrade and Jagodina (15 min)**

**Dragan Radmilović**

Light pollution is very pronounced in the cities of Serbia. Since 2000 began mass lighting of building facades, and religious facilities. In my work can show the example of two of Belgrade (with about 3,000,000 residents and Jagodine (with 70,000 inhabitants) the extent of light pollution.

### **On the verge of light pollution – the current state of lighting in Macedonia (15 min)**

**Partalovski Filip, Skopje Astronomical Society**

Urban, but not modern. That's what most of the cities in Macedonia are like. And that's the case with urban lighting too. For a decade the members of the Astronomical Society have been escaping Skopje for darker skies, almost 40km to the south of the city, and now it seems that is also too close to home. We can't escape forever, so we're going to try preventing light pollution while the society is developing so we won't have to cure it later on.