Checking the light pollution sources at Asiago Astrophysical Observatory from photometric and spectroscopic observations. Results from a unique experiment

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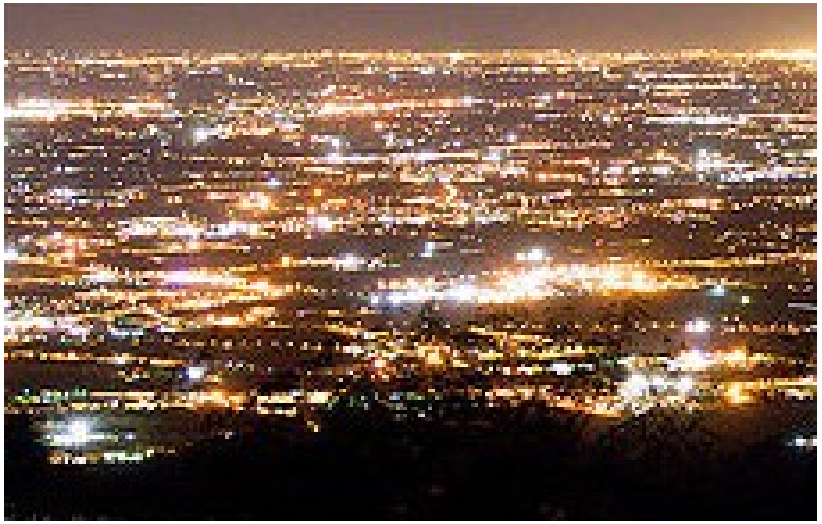
Astronomical observatories in Italy (yellow), owned by INAF or local Universities.
Asiago Observatory is at North-East, in the Veneto region.
4.9 Ml inhabitants in Veneto with 300 to 400 inh./km^2 (Los Angeles 1200 inh./km^2)
Limited population increase in the last century (<factor 2) in contrast to LA (factor 20).
Population stable on the plateau (1000m) 878 km^2 with 21 inh./km^2 habitants in 7 villages.

But the luminance is increasing about 6%/year. Veneto region is like a huge sparse city with a few dark spots. Light pollution regional protection law (1997->**2009**): a committee, astronomers included, **have** to check the law effects and report to the regional administration. Starting in 2011 we installed 3 SQMs.

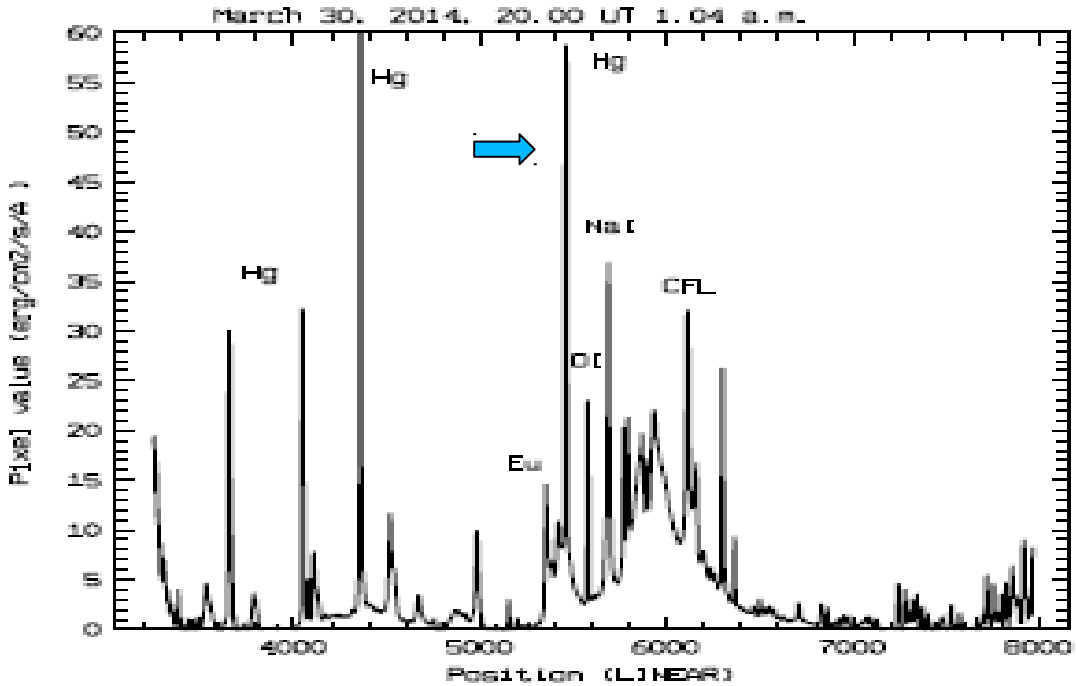


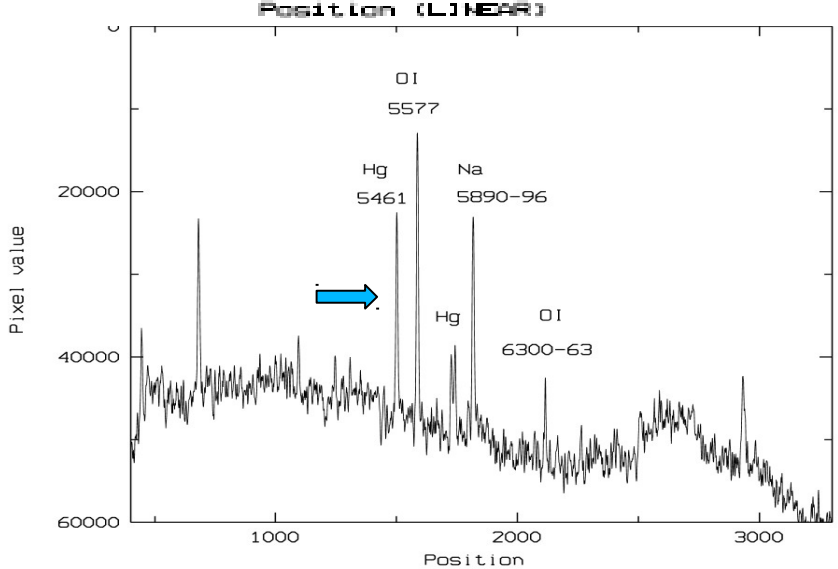
Asiago Observatory: 4 telescopes (1.8m, 1.2 m, 2 Schmidt telescopes) in two locations. (1) Pennar, 1000m altitude, near Asiago village, and (2) Ekar 1300 m, more distant, but closer to the edge of the plateau. 200 usable nights/year

The southern sky at Asiago-Ekar (Jan. 2015): strong pollution altitude gradient

Paranal, Aug. 28, 2013: dark down to the horizon

Polluting the sky: 2014 spectra (Berton 2014) + **old plates from 1979, low pollution sky (Hg lamps only, no Na)**





The 2009 Veneto regional law: two innovative concepts

Art. 6 n.1 É istituito, presso la direzione generale dell'Agenzia regionale per la prevenzione e protezione ambientale del Veneto (ARPAV), di cui alla legge regionale 18 ottobre 1996, n. 32 , l'Osservatorio permanente sul fenomeno dell'inquinamento luminoso, di seguito indicato come "Osservatorio".

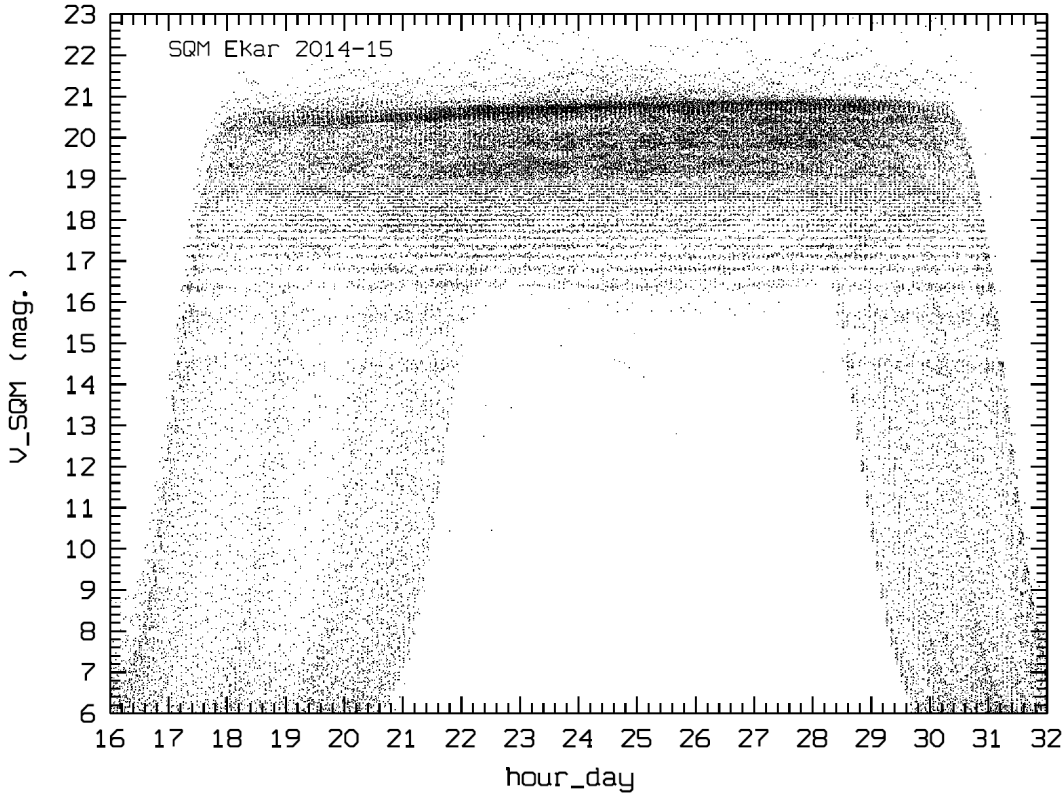
Art. 8 n.13 Su richiesta degli osservatori di cui agli allegati A e B, in coincidenza con particolari fenomeni e comunque per non più di tre giornate all'anno, i sindaci dei comuni ricadenti all'interno delle fasce di rispetto di cui al comma 7 dispongono, compatibilmente con le esigenze di sicurezza della circolazione veicolare, lo spegnimento integrale ovvero la riduzione del flusso luminoso degli impianti pubblici di illuminazione esterna.

Sect. 6, n. 1: The regional agency for the environmental protection (ARPAV) nominate a permanent committee "Observatory on the light pollution"...

Sec. 8, n. 13: Upon request of the Astronomical Observatories, in connection with specific events, the local administrations dispose to turn off completely (or to reduce) the public outdoor illumination, up to 3 nights per year...

Monitoring Asiago-Ekar Observatory sky background
about half million data from SQM since 2011

Another installed at Pennar in 2014.



Soardo, 2008; Cinzano, 2008

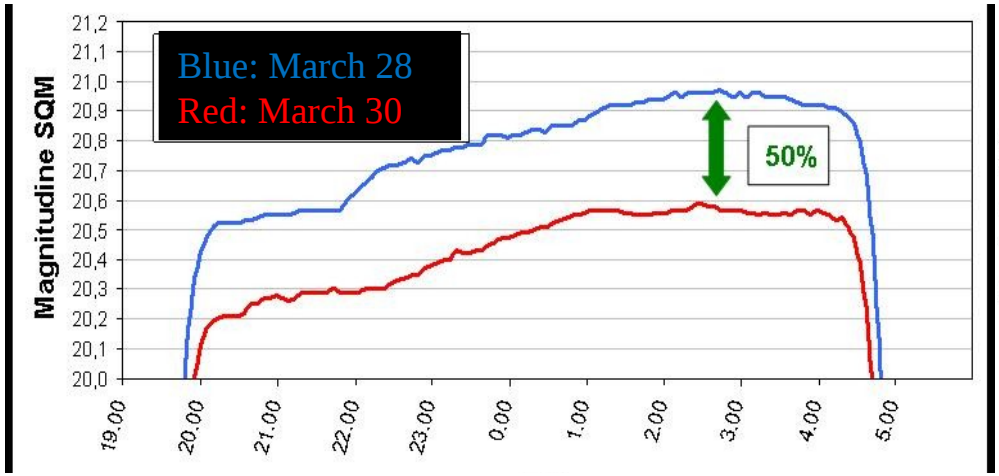
Cavity model vs. Garstang

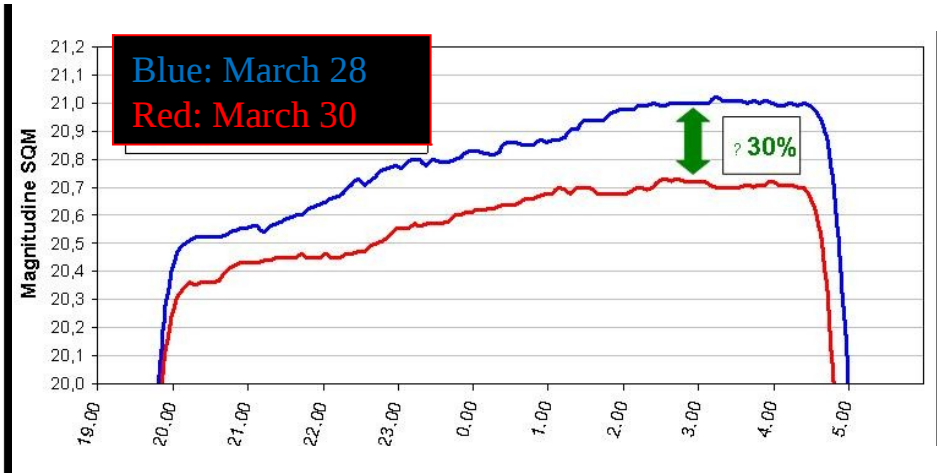
A unique experiment at Asiago Observatory: **5000 street lamps turned off in the night of March 28th** involving a population of about 20,000 people on an area of almost 700 km^2. **About 500 kW off all the night (about 30 Ml lumens).**

The sky was photometric. Measurements have been carried out with 4 SQMs, and observations obtained with 3 telescopes

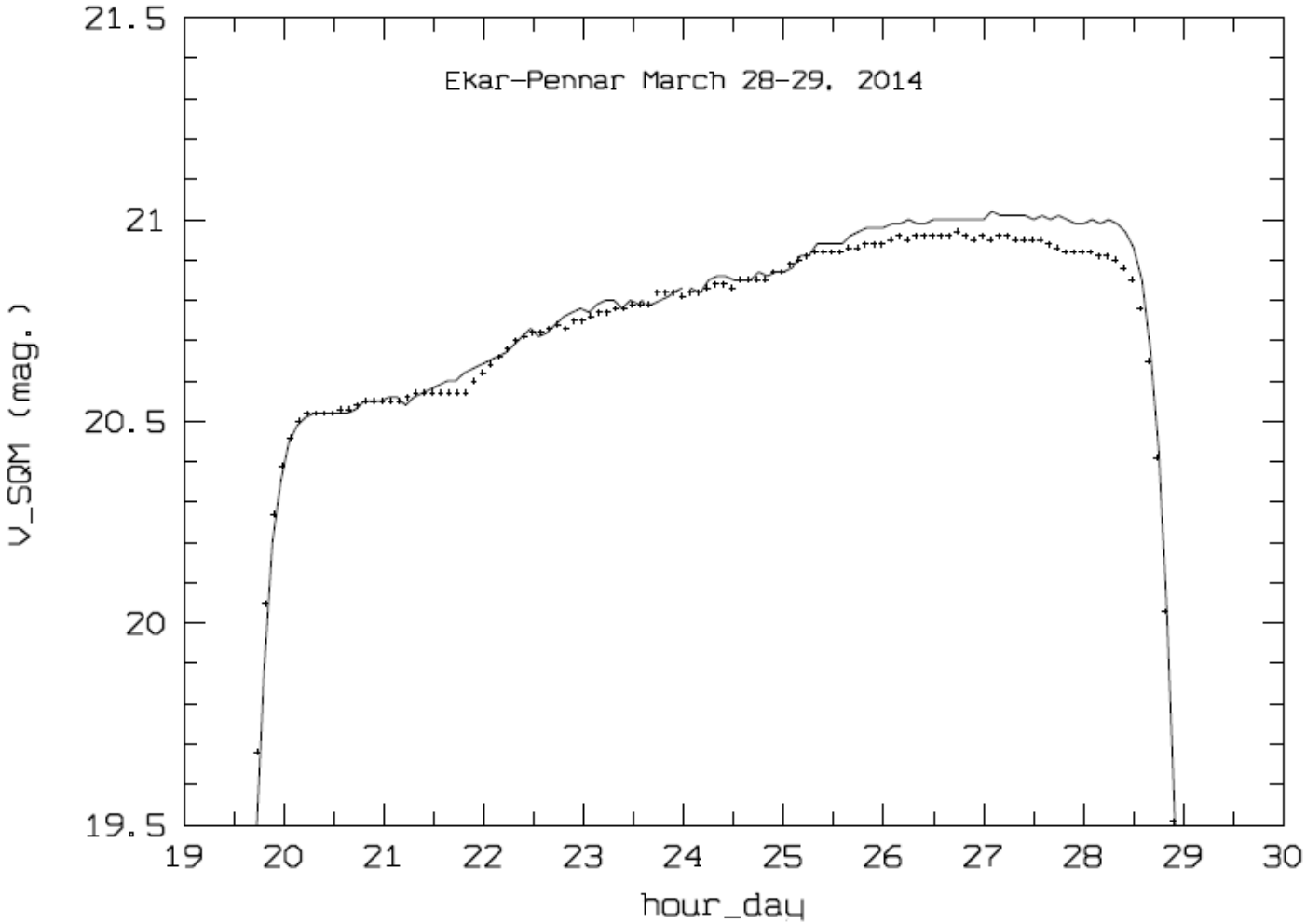
The main villages felt in a shocking, silent spectral darkness , dominated by shining stars around the zenit

Sky brightness difference between the 28 and 30 of March, 2014 at Ekar and Pennar. The gain was considerably higher at Pennar (**50%**) than at Ekar (the more distant site from Asiago) (**30%**).
The gain increased along the night. No tight correlation.

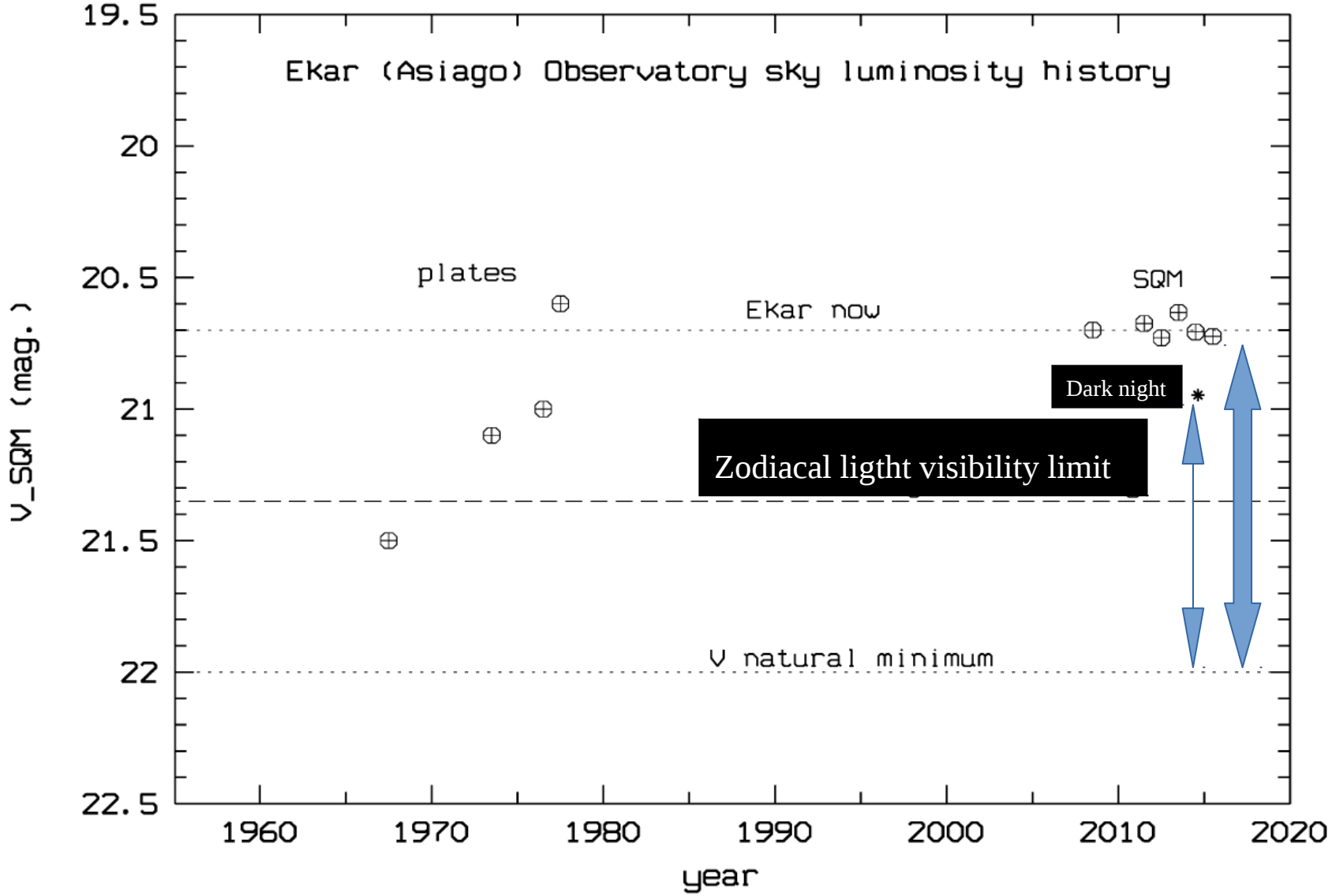




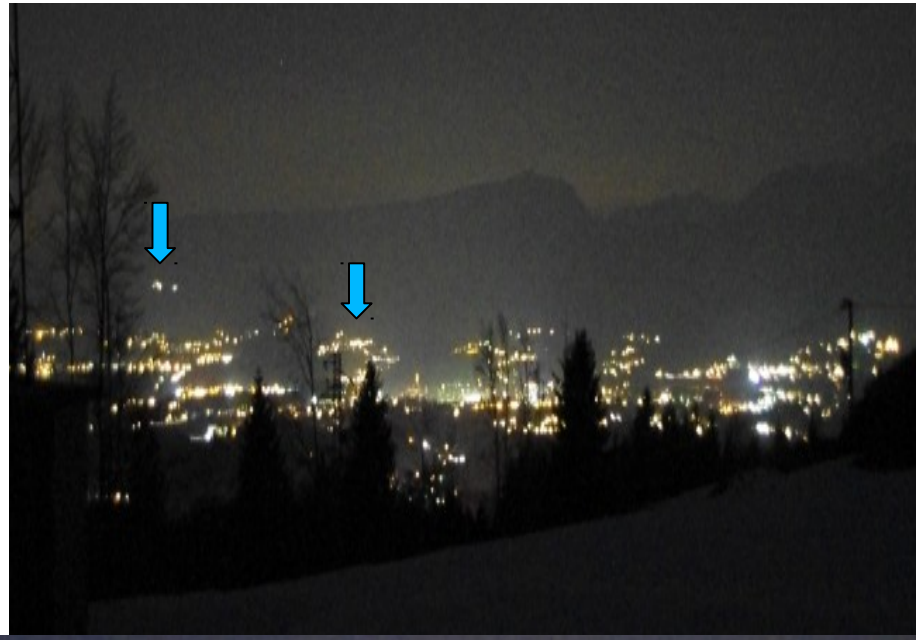
In the «dark» night same sky brightness in the two sites

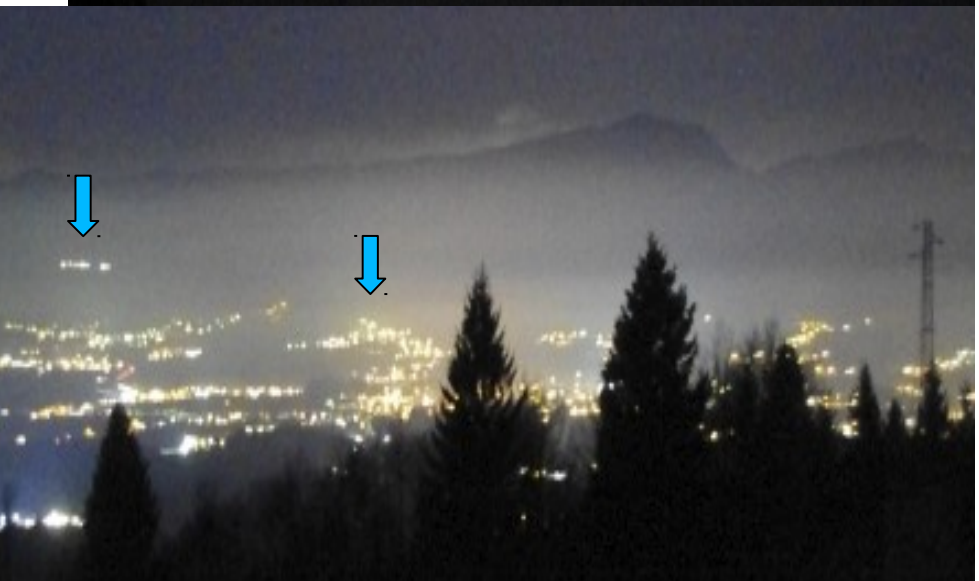


The history of the light pollution the contribution in the “dark night”



Dark night (March 28, 2014) vs. Jan. 13, 2015: private lights about 50% of the total





Results:

1-A wrong statement:

"No norm is better for observing the sky than the lack of lighting: observatories should be surrounded by dark zones **(the so-called "star parks")**, where lighting installations should not be allowed."

This is wrong: distant lights (50-200 km) significantly affect the sky over the observatories.

2-Private installations

The contribution of the private illumination, including parking lots, sport activities, bus-train stations, gardens, is relevant, and can account for about 50% of the total light pollution. It should be put under control.