BACK-SCATTER MEASUREMENHTS FROM LOCAL ATMOSPHERE

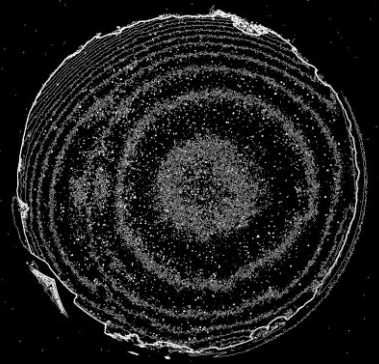
The 2 pictures below shows the 2 telescopes reference wall mounted LED panel calibration lights mounted vertically. For the backscatter measurements, one is used by remounting it horizontally below observatory wall, shown below right. It is turned on and off repeatedly measuring SQM sky brightness only seeing the backscatter, for each case.

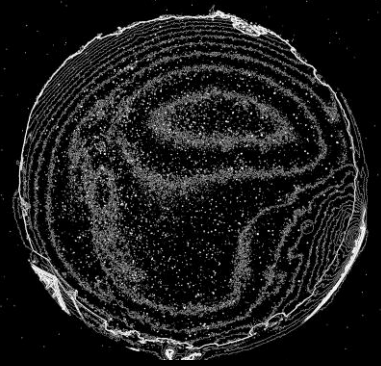
SQM (20 deg .fov), tilted 20 deg. N of Zenith, away from observatory panel lights with no direct or reflected view.

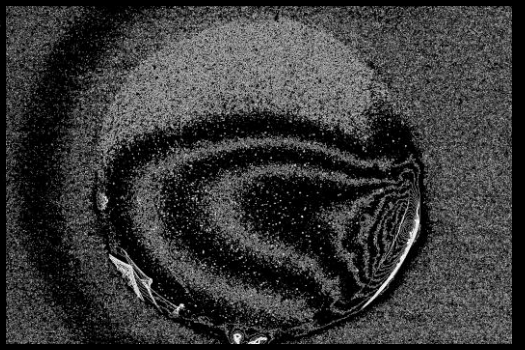
2 Vertical mounted LED panel lights.

Horizontal re-mounted LED panel light.

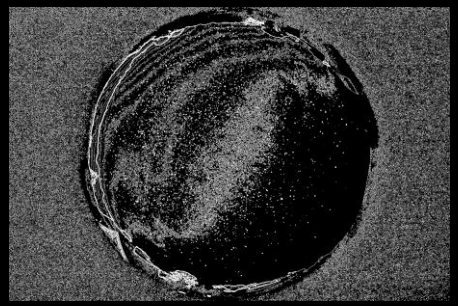
Example:- 2021-06-08 Lights Off/ On :- Sky background



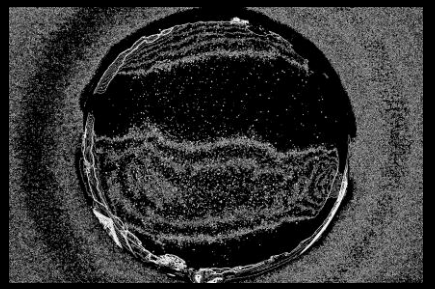




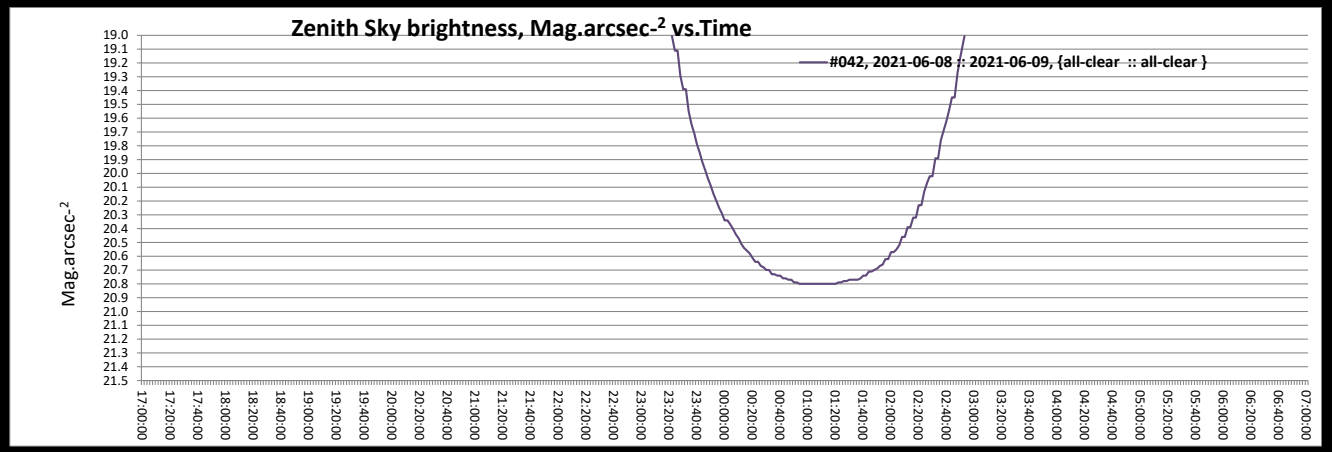
2021-06-08 Lights Off, isophotes, and 180deg asymmetry, from left –right flip, then frame subtraction.



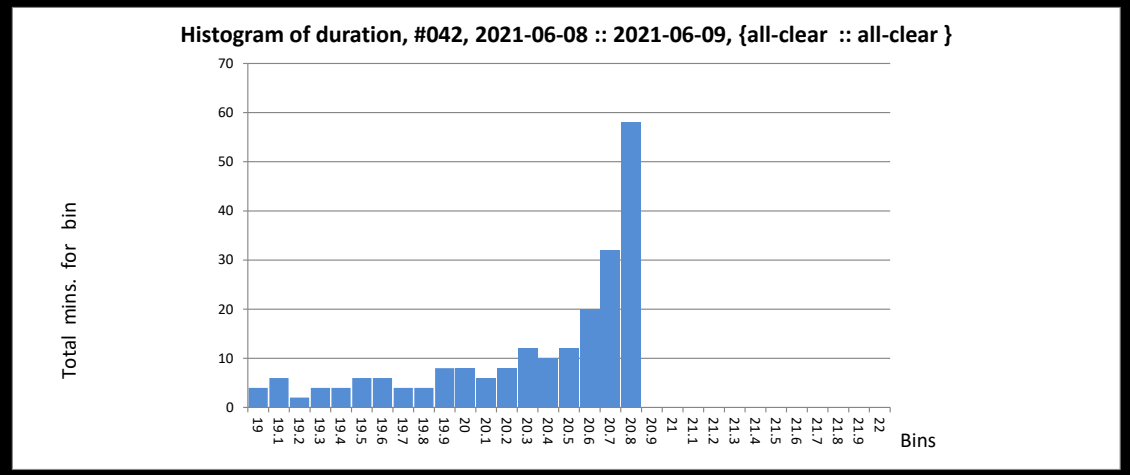
2021-06-08 Lights On, isophotes and 180 deg asymmetry.



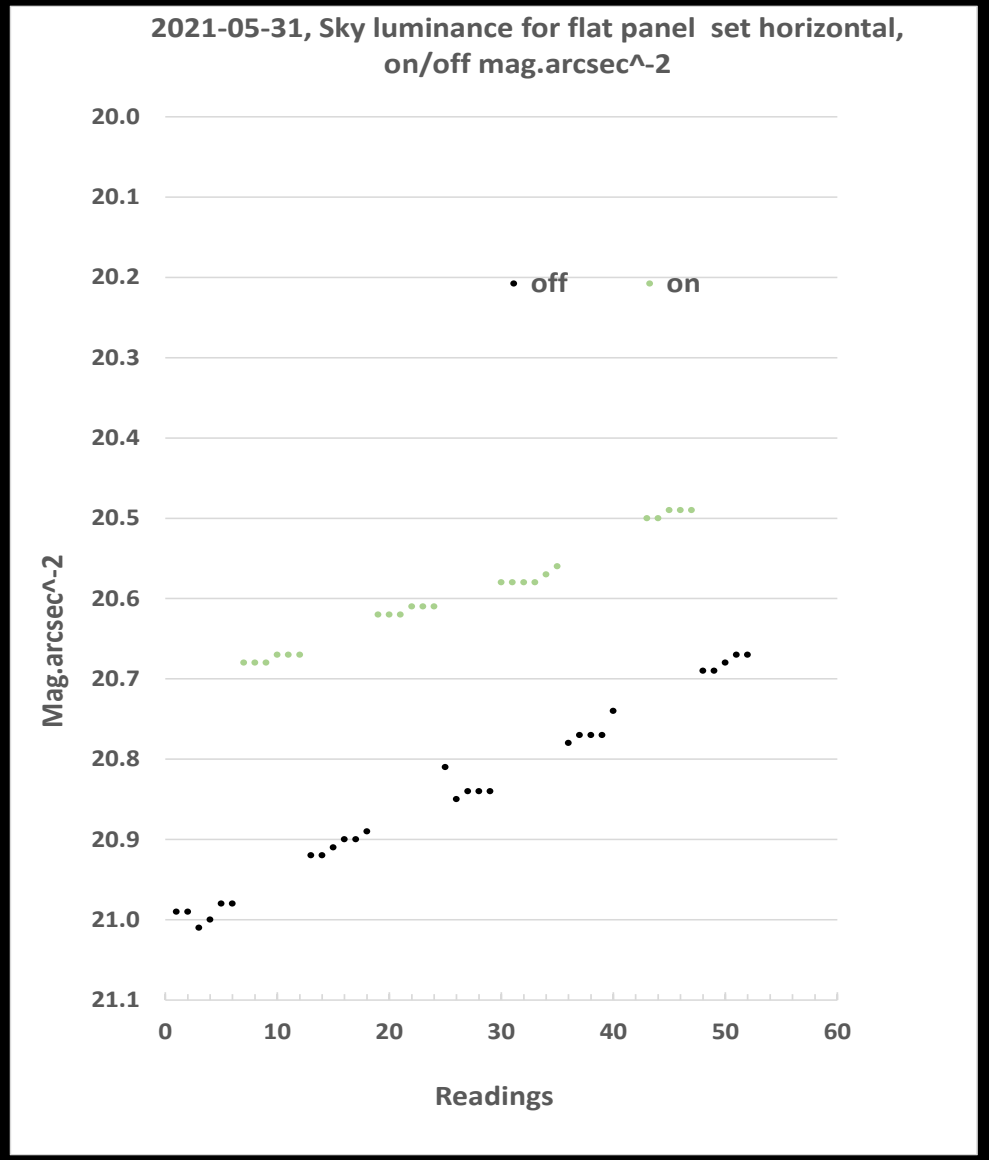
2021-06-08 Lights On - Off isophotes. The camera sees reflections but the SQM with its 20 deg. field of view mounted higher and tilted 20 deg. N. of zenith, does not see that.

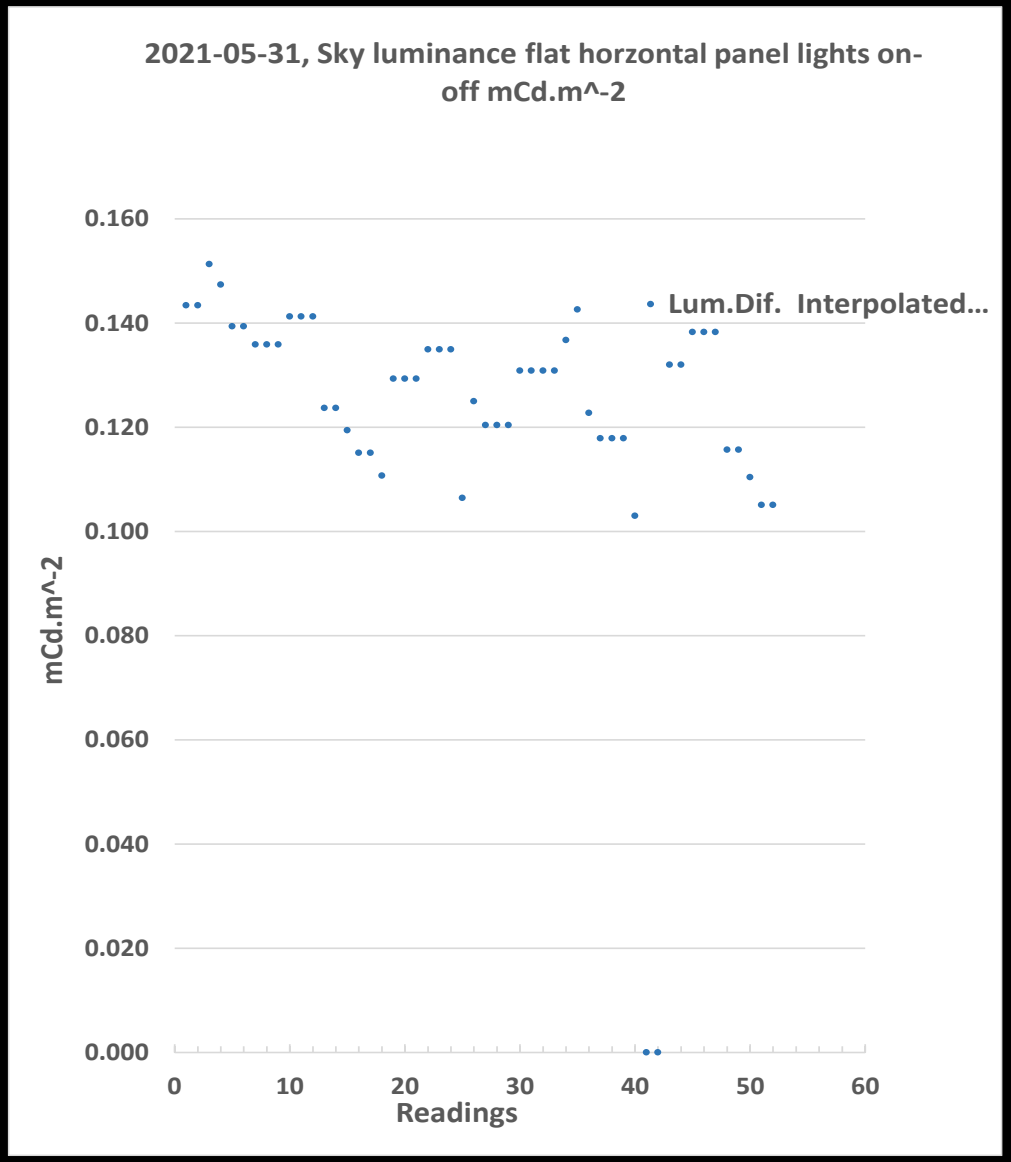


2021-06-08/09 Time plot, clear sky. Near identical to 2012-06-08 but without lights on/off interruptions.

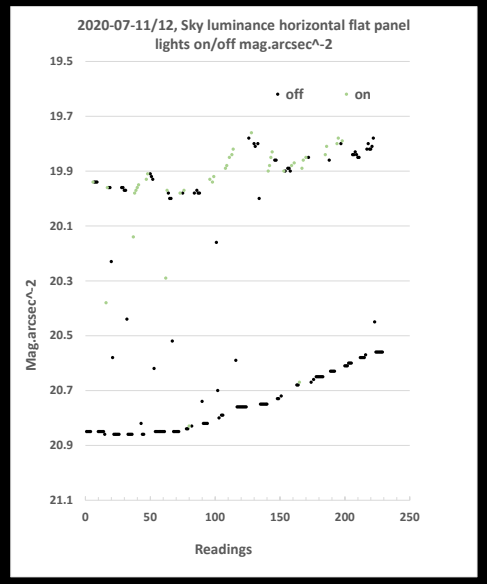


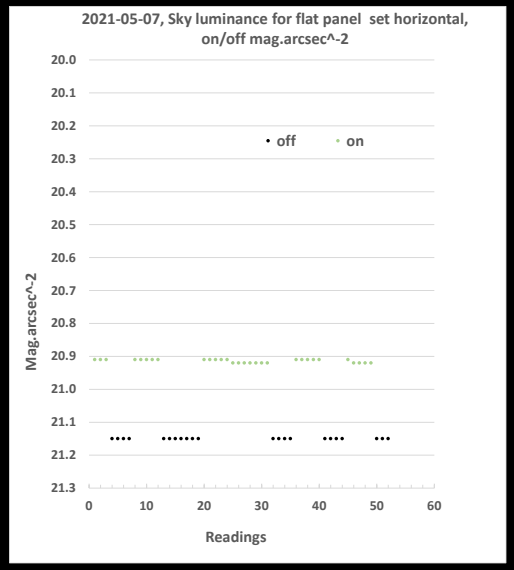
2021-06-08/09 Histogram, clear sky

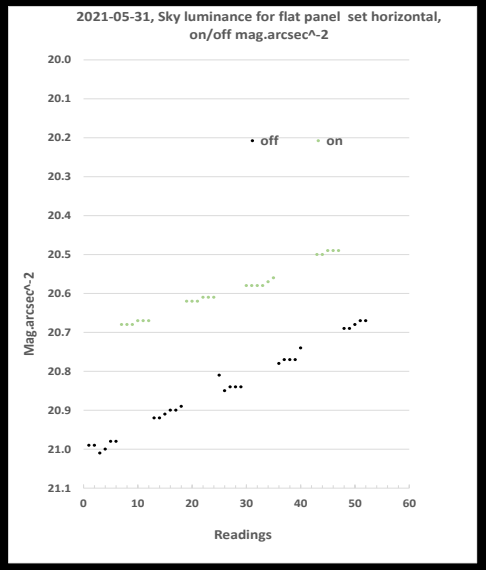


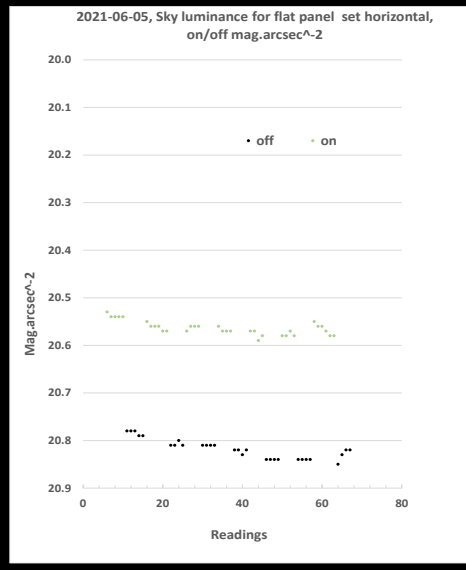


Example of measured sky luminance at the Mathon observatory, from flat panel source, mounted horizontally out of sight of the mast mounted SQM, with lights off and then on repeatedly near midnight. The sky background level is always changing. Then the absolute difference of lights on or off to interpolated off when on, on when off.



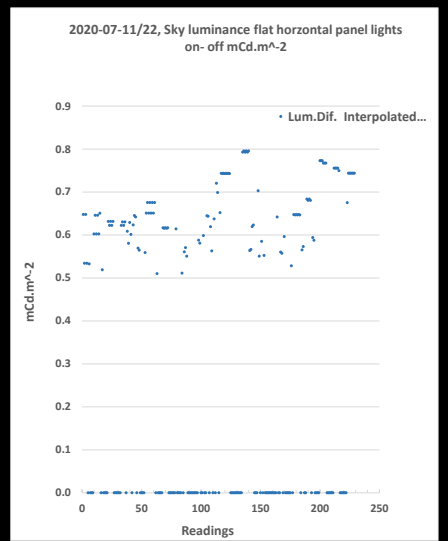


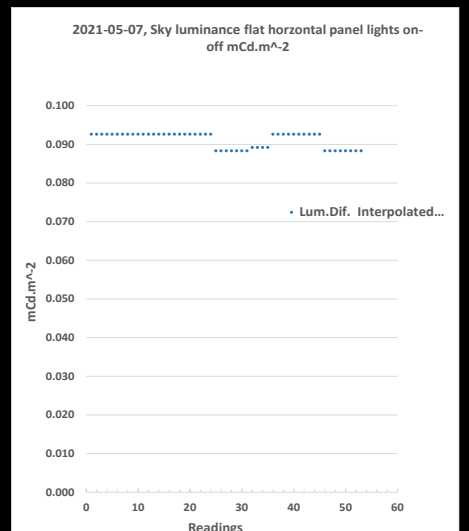


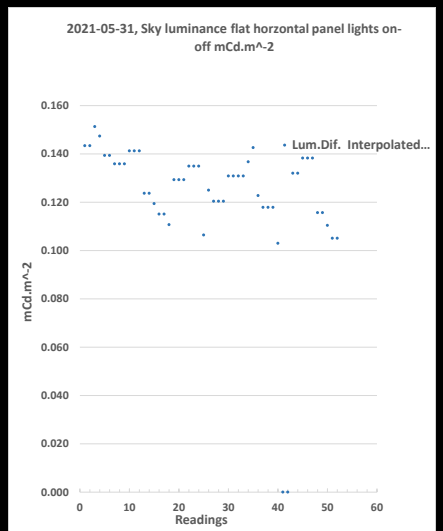


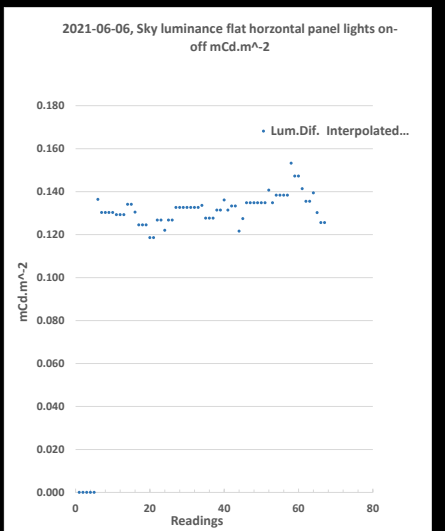
Set of measured sky luminance at the Mathon observatory, from flat panel source, mounted horizontally out of sight of the mast mounted SQM, with lights off and then on repeatedly for about 1 hour near or soon after midnight. The sky background level is always changing.

Then the absolute difference of lights on or off to interpolated off when on, on when off.

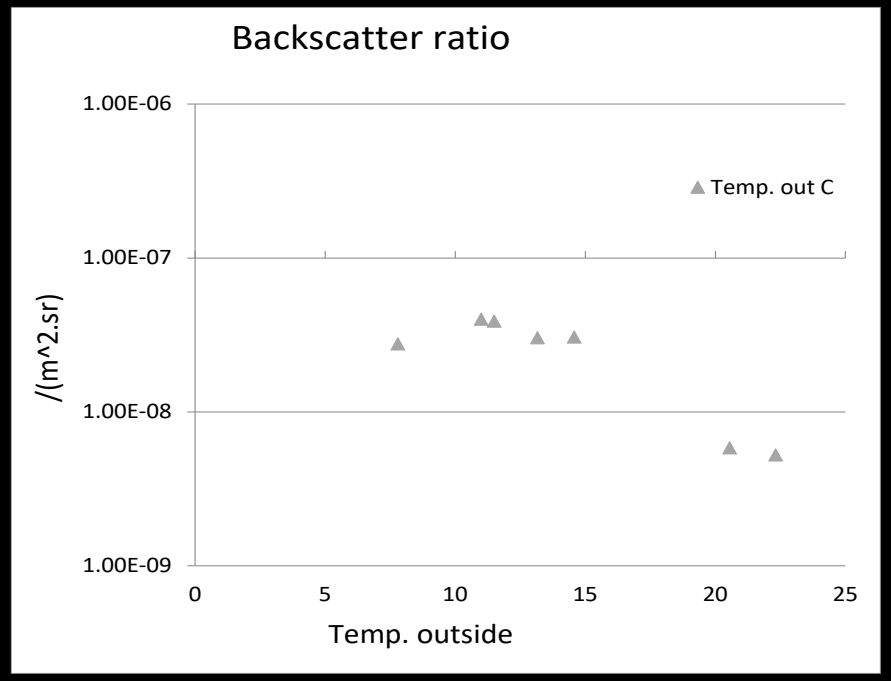


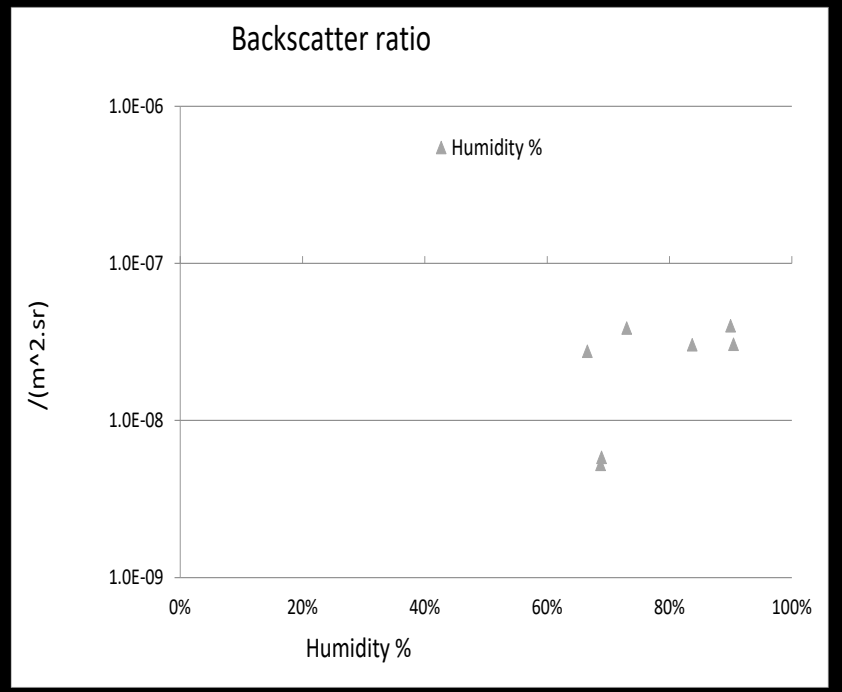






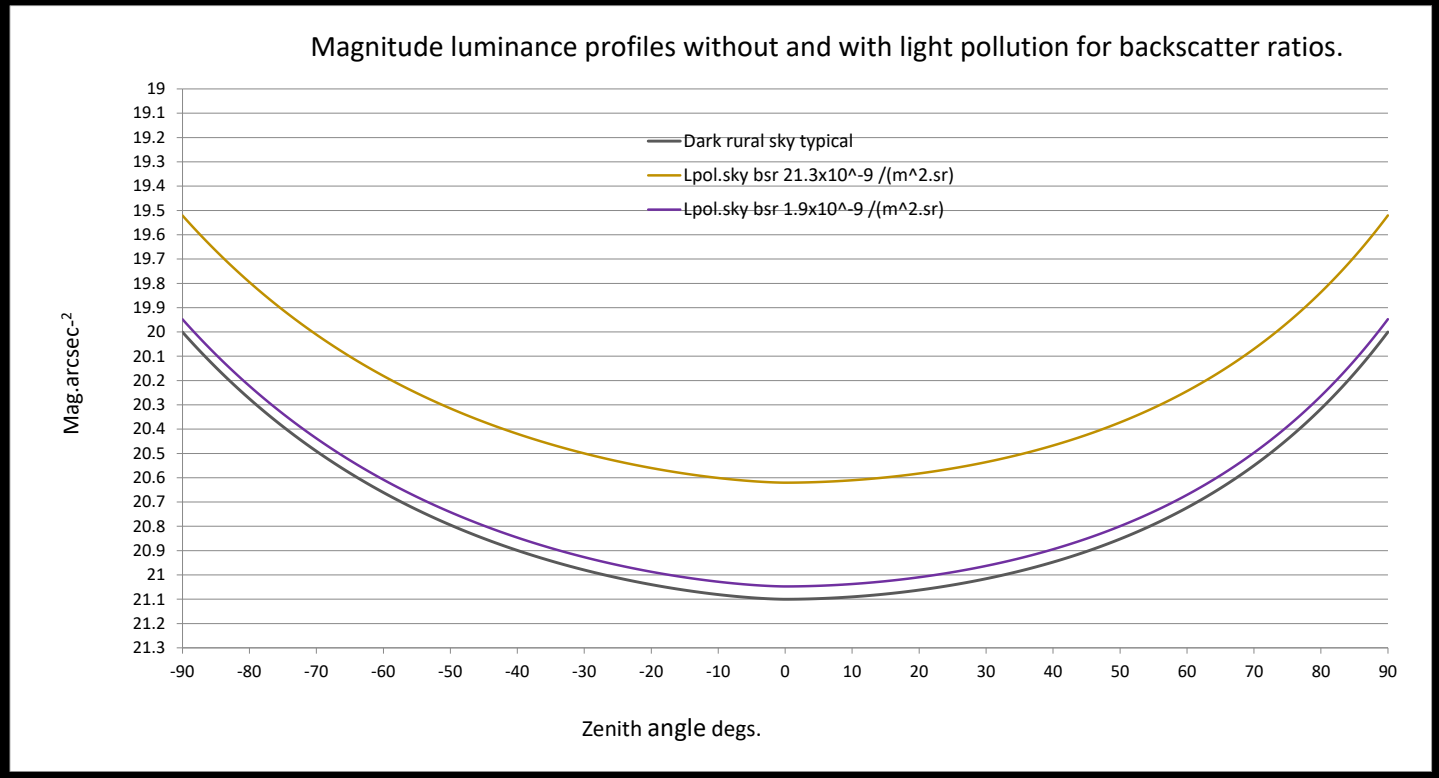
Date	Av. Bgd.Mag.arsec^-2	Source Lum.	Sky Lum.Dif mCd/m^2	Std.	Back scatter ratio /(m^2.sr)	Std. %	Temp. out C	Humidity %	Windspeed km/h
2020-06-23	20.53	5469	3.19E-02	2.00E-02	5.83E-09	62.9%	20.6	69%	3.8
2020-06-24	20.59	5469	2.87E-02	1.61E-02	5.25E-09	56.1%	22.3	69%	2.0
2021-05-07	21.15	3300	9.12E-02	1.98E-03	2.76E-08	2.2%	7.8	67%	0.1
2021-05-31	20.84	3300	1.28E-01	1.20E-02	3.88E-08	9.4%	11.5	73%	0.0
2021-06-05	20.92	3300	1.01E-01	6.67E-03	3.06E-08	0.7%	14.6	90%	0.0
2021-06-08	20.82	3300	1.32E-01	6.32E-03	4.00E-08	0.6%	11.0	90%	0.0
2021-06-13	20.72	3300	1.00E-01	5.74E-03	3.03E-08	0.6%	13.2	84%	0.0





Determined backscatter ratio for outside temperature, humidity, no obvious correlation.

Predicted effect from downward pointing only controlled lighting of an intended housing estate, assuming similar atmospheric conditions.



Predicted horizon to horizon sky brightness profile from planned housing estate lighting compared with a clear night natural background empirical model (grey), as a function of zenith angle seen from the estate where an observatory exits.

Here a difference of 0.5 mag.arcsec^-2 for medium back scatter, humidity >85% (orange), and 0.1 and for low back scatter (violet), according to local weather and time dependent conditions.

In the case modelled, for a well designed new housing development. The effect would locally significantly reduce to near invisibility of the Milky Way.

Summary

The local atmospheric backscatter ratio has been determined caused by purely ground reflection.

Even a well designed housing development lighting scheme with no direct lighting to the observer, the increase in local sky brightness increase would result in near invisibility of the Milky Way.

No commercial lighting layout programs consider atmospheric scattering.