

Skinakas Observatory BVR Sky Brightness During Dark time and Sunspot minimum



Spectrophotometric Observations

All spectra were taken with the Andor DZ436 CCD camera on the focal reducer low dispersion slit spectrograph, mounted on the 1.3m telescope on August 23, 2008, with a grating of 651 lines/mm blazed at 5300 Å. The entrance slit width used was 200 μm (4.2" projected on the sky). Two different setups were employed to give wavelength coverage in the ranges 3500 - 7150 Å (hereinafter set-up A) and 4800 - 8550 Å (setup B), with a respective dispersion of 1.8328 Å/pix and 1.8467 Å/pix.

Exposures of a quartz lamp through a diffuser plate in front of the slit, as well as twilight sky images were combined for flatfield correction. Wavelength calibration was provided with the exposures of a FeHeNeAr lamp. The observations were flux calibrated through observations of spectrophotometric standard stars. All night sky spectra were taken during the moonless part of the night, with the telescope tracking at its normal rate and pointing at a "blank" sky field, centred at RA = 19:21:29.0, DEC = +12:27:49 (J2000). Three consecutive 20min exposures in set-up A were taken, followed by a similar set in setup B. At the beginning and end of each set, halogen-quartz lamp and arc exposures were taken for fringe correction and wavelength calibration purposes. Fig. 7 shows the telescope pointings along with a log of the observations.

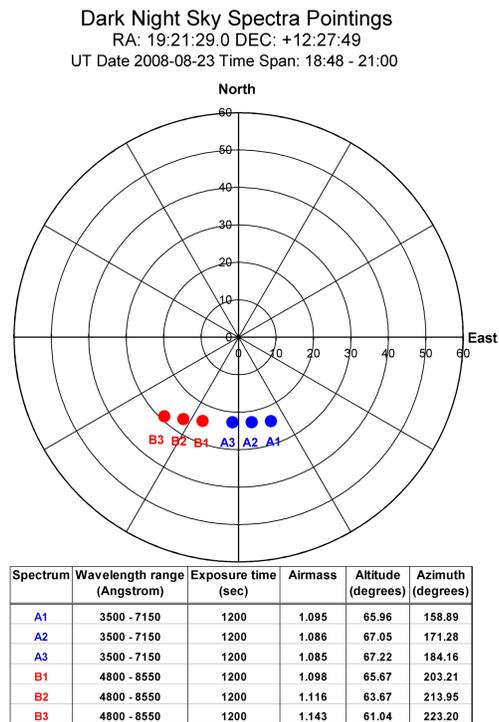


Fig. 7. Telescope pointings of the night sky spectral observations on the local horizontal coordinate system and the log of the exposures taken.

The data were reduced using the "longslit" package in IRAF. Zenith correction was applied to the flux calibrated spectra, in the same manner as in the photometric analysis. Sky exposures belonging to the same instrument setup (A or B) were averaged and the resulting spectra are shown in Fig. 8 and 9, both in flux units and AB magnitudes per squared arcsec. Fig. 10 gives a detailed identification of the spectral lines detected (whenever this was possible) with a different color code for emission lines of airglow origin and artificial lighting sources.

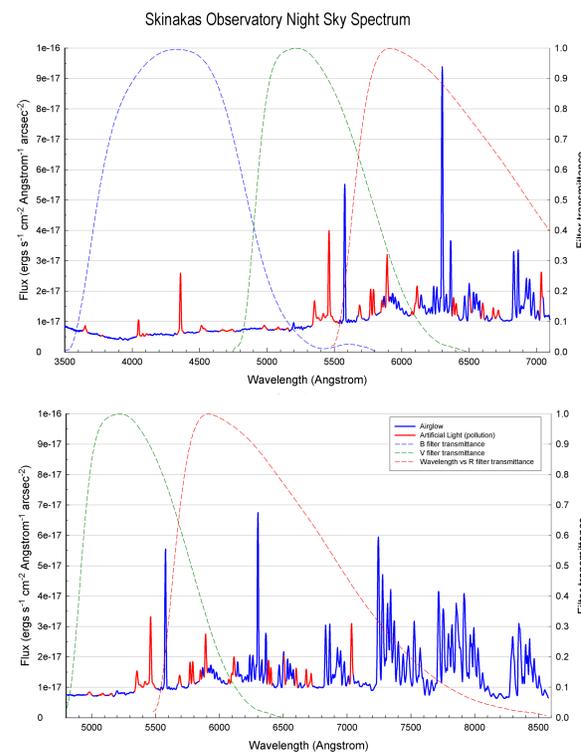


Fig. 8. Night sky spectra in the optical wavelength ranges 3500-7150 Å (top, set-up A) and 4800-8550 Å (bottom, set-up B) in flux units. The blue continuous line corresponds to emission due to airglow and the red continuous line to artificial lighting sources. The dashed lines depict the normalized transmittance curves of the filters B (blue dashed line), V (green) and R (red), with their values read on the vertical axis to the right of each frame.

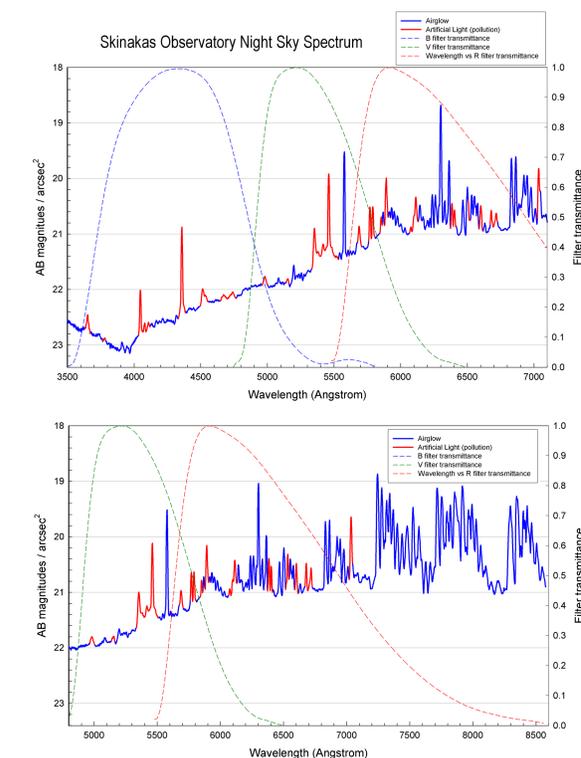


Fig. 9. Same as Fig. 8 with sky brightness in AB magnitudes.

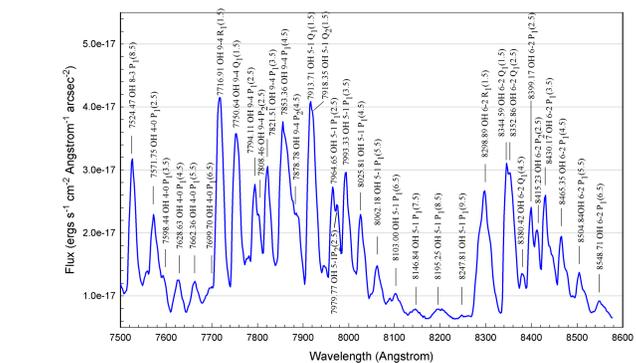
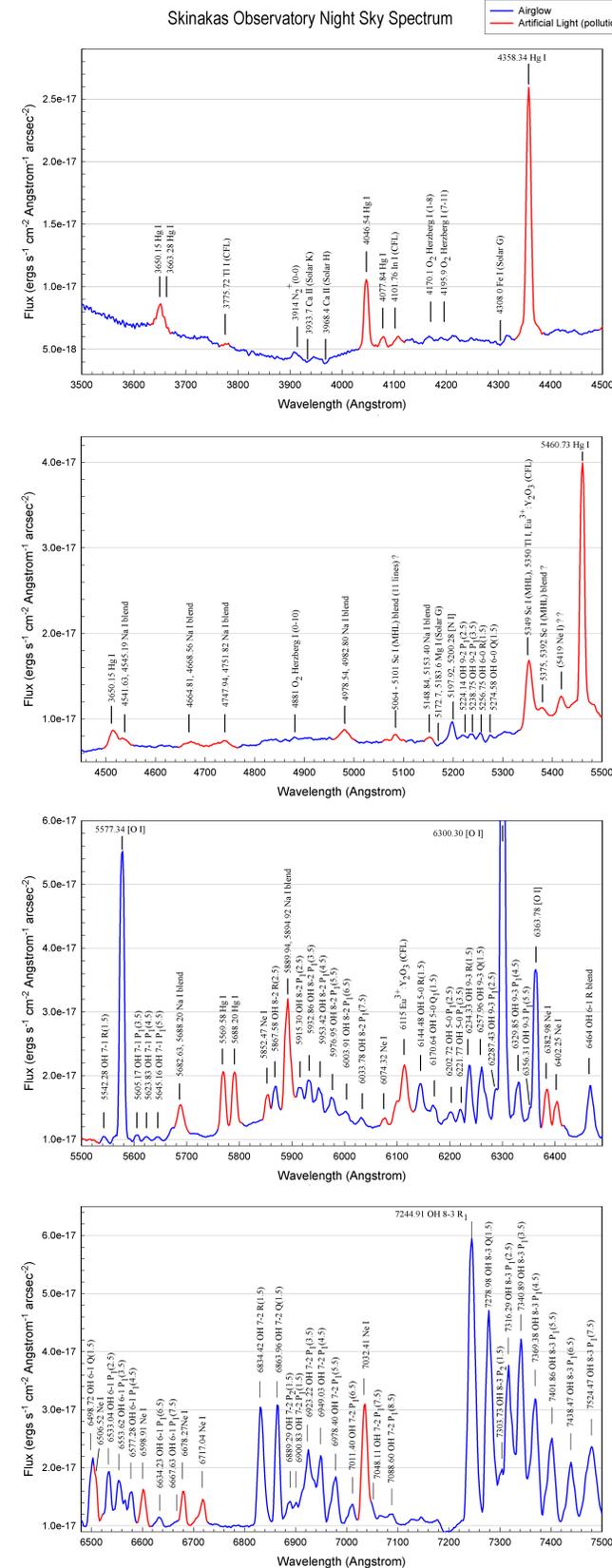


Fig. 10. Identification of emission lines in sky spectra. The color code is as in Fig. 8.

To estimate the contribution of light pollution to the night sky surface brightness in each of the three passbands BVR, we derived the flux intensity that corresponds to each of the detected emission lines attributed to artificial lighting sources. The spectra were convolved with each filter's transmittance curve, the local background was estimated by a linear fit and subtracted, and the integrated flux was converted to AB magnitudes per squared arcsec. Table 1 lists the contribution of each pollution line in each filter's passband along with the line identification and the nominal wavelength of the detected line.

TABLE 1
CONTRIBUTION OF LIGHT POLLUTION LINES TO SKY BRIGHTNESS

Line ID	Wavelength (Angstrom)	Δmag B filter	Δmag V filter	Δmag R filter
Hg I	3650,3663	0.0012	--	--
Tl I	3776	0.0003	--	--
Hg I	4047	0.0082	--	--
Hg I	4078	0.0013	--	--
In I	4102	0.0017	--	--
Hg I	4358	0.0355	--	--
In I	4511	0.0062	--	--
Na I	4542,4545	0.0031	--	--
Na I	4665,4669	0.0030	--	--
Na I	4748,4752	0.0034	--	--
Na I	4979,4983	0.0031	0.0047	--
Sc I	5064-5101	0.0011	0.0032	--
Na I	5149,5153	0.0003	0.0013	--
Sc I, Tl I	5349,5350	0.0014	0.0205	--
Sc I	5375,5392	0.0005	0.0087	--
Tb IV	5426	0.0005	0.0118	0.0001
Hg I	5461	0.0017	0.0556	0.0008
Na I	5683,5688	0.0003	0.0084	0.0036
Hg I	5770	0.0004	0.0079	0.0052
Hg I	5791	0.0004	0.0073	0.0054
Ne I	5852	--	0.0021	0.0021
Na I	5890,5895	--	0.0109	0.0125
Broad NaD	~5900	--	0.0485	0.0701
Broad CFL	~6250	--	0.0036	0.0382
Ne I	6074	--	0.0002	0.0009
Eu IV	6115	--	0.0022	0.0080
Ne I	6383	--	0.0001	0.0042
Ne I	6402	--	0.0001	0.0029
Ne I	6507	--	--	0.0037
Ne I	6599	--	--	0.0035
Ne I	6678	--	--	0.0028
Ne I	6717	--	--	0.0030
Ne I	7032	--	--	0.0081
TOTAL		0.0720	0.1836	0.1651