The Measurement of Spectral Response of a Blue LED as Radiation Detector.

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1. Introduction.

HEAD_1/HEAD_2 "Hawk Eye Apogee Detector" for Experimental Rocketry (Foto 1, 2)

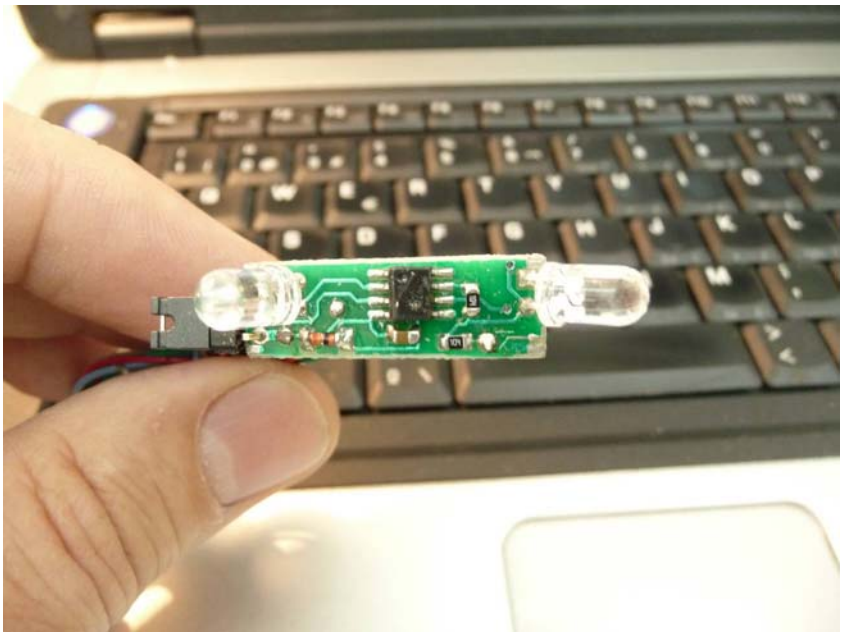

Photo 1.

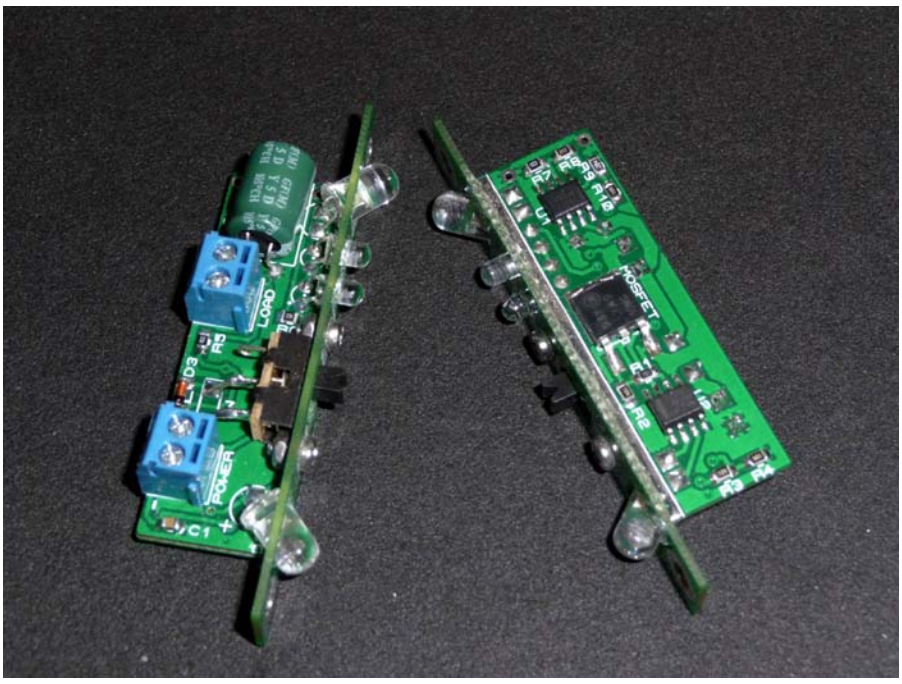

Photo 2.

2. Experiment.

Object: commercial UV/Blue LED.
Locality: Spectroscopy Lab. San Carlos de Bariloche, Patagonia, Argentina, (Longitude: -61º 21 60.0, E; Latitude: -41º 35 60.0, N), 17.0-17.30 hours. Cloudless.
Se-Up: Sun Spectrometer of the optional tipe:

- Diffraction Grating at 1200 gr/mm, blaze angle @ 5000 нм, (Mc-Pherson) (Photo 3) ;

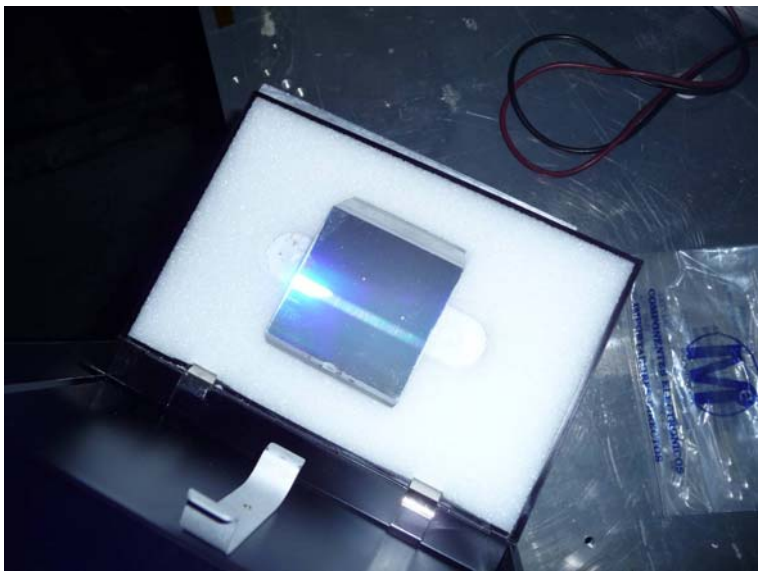

Photo 3.

- Source: High Intensity Natural Wide Spectral Range (Sun);
- Detector: Blue LED in closed housing with entrance - 3 мм, (Photo 4);

Photo 4.

- Signal Registrator: Gold Star Digital multimeter. III Class;
- Photografic Digital camera: Panasonic_Lumix_DMC-TZ4.

Measurements was performed at the fixed position of a spectrum, which approximate wavelength was defined visually with an error approximately in 10 % (it is didn't influence the purpose of researches). The result of the signal measurement was fixed by the photographic camera from the Multimeter display. Process of the measurements (three basic points) is depicted on Photo 6-11. The signal from an integrated flux of a natural source (Sun) was registered by installation of a measuring head (LED) in relation to a source on the maximum signal on a Multimeter. This signal equaled 2.15 V (Photo 5).

Photo 5.

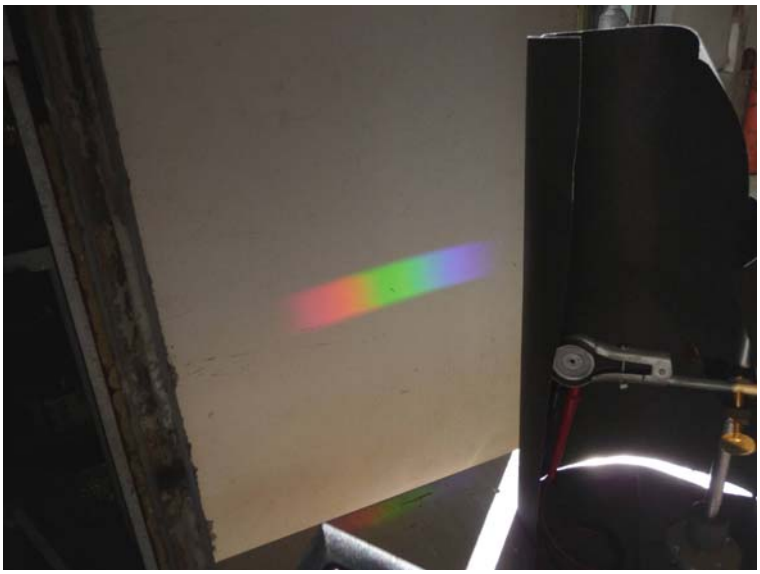

Photo 6 (Sun VIS Spectrum in the 1º of diff. Grating).

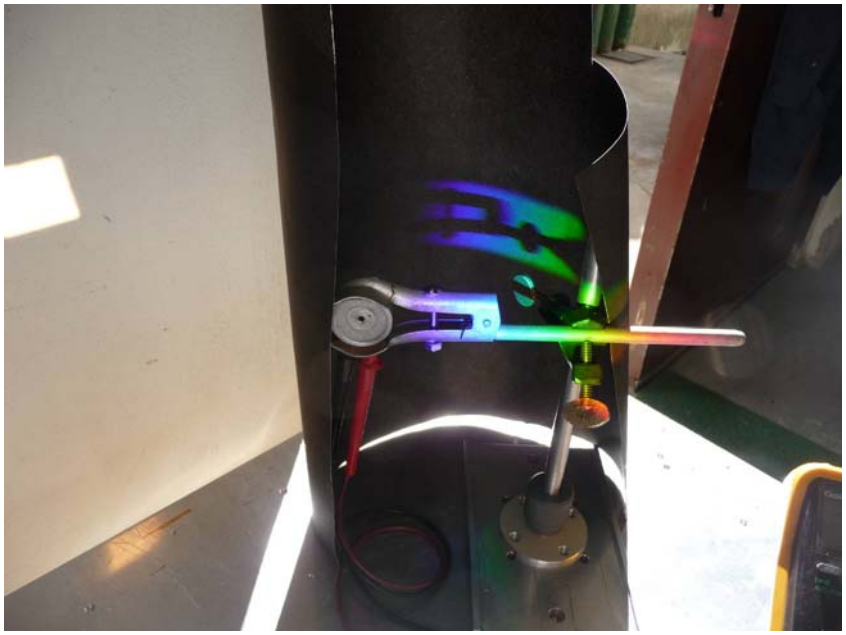

Photo 7 (360 nm approx. Spectrum position).

Photo 8 (360 nm. Multimeter signal).

Photo 9 (460 nm approx. Spectrum position).

Photo 10 (460 nm. Multimeter signal).

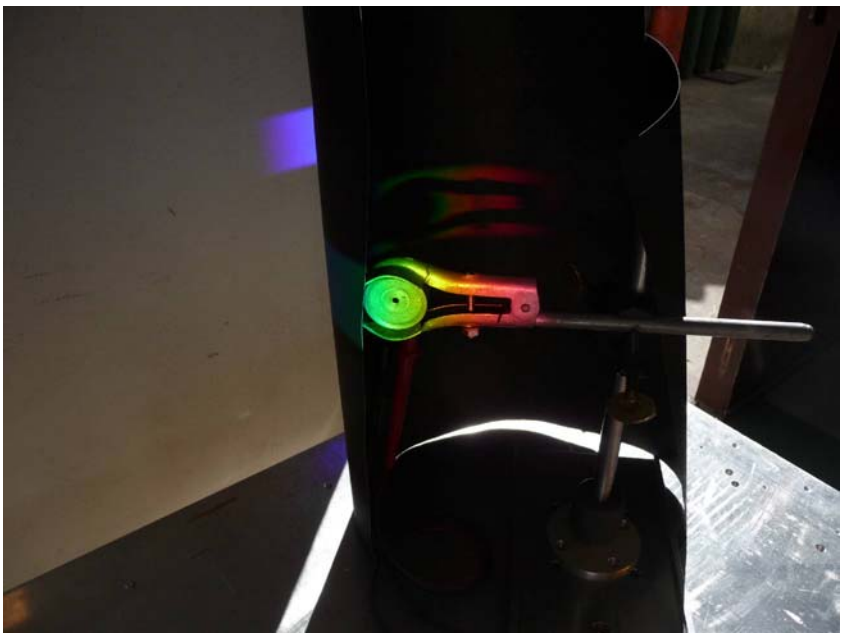

Photo 11 (560 nm approx. Spectrum position).

Photo 12 (560 nm. Multimeter signal).

3. Experimental Results.

The results of the measurements have been reconstructed with MS Origin-6.1 Program. Experimental diagram Signal vs.Wavenumber is depict on a Fig. 1.

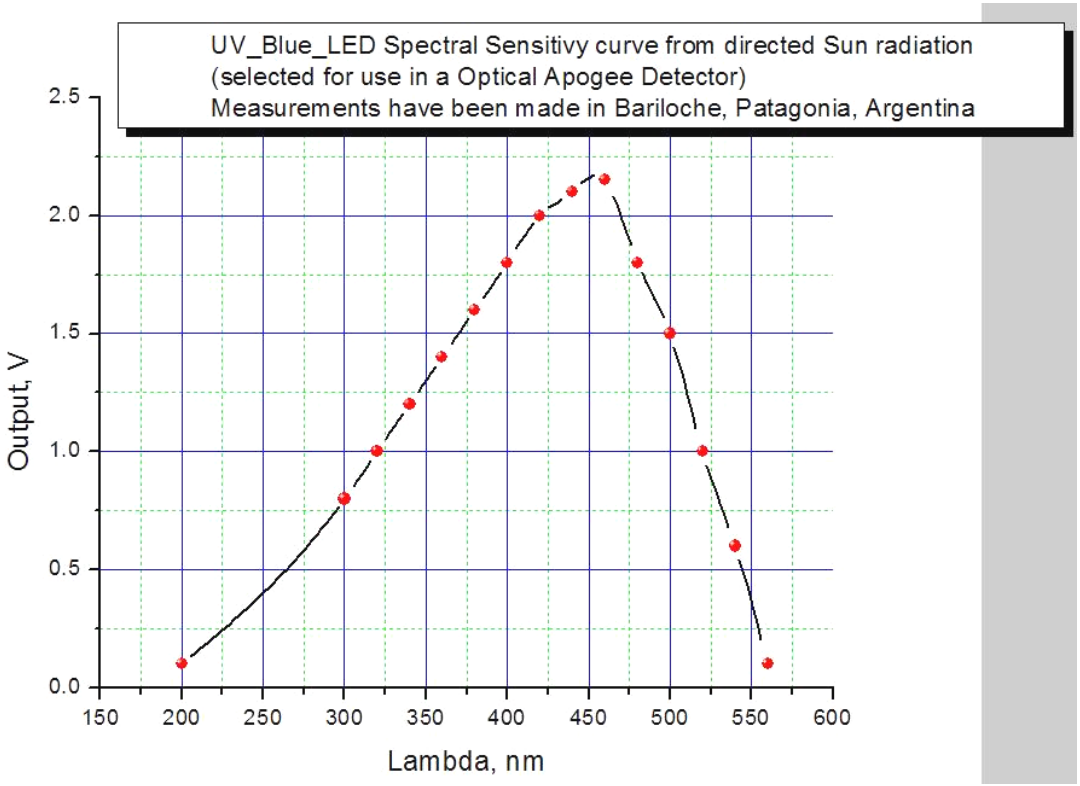

Fig. 1.

Except the basic measurements of spectral sensitivity of the given selective photodetector, additional researches of influence various transparent in VIS materials on them Transmittance in UV have been made. So, the plate of *Poly(methyl methacrylate)* (PMMA), thickness of 12 mm has been entered into a radiation of 460 mm (LED response maximum). Signal easing of all on 5-6 % (Photo 13-14) has been registered.

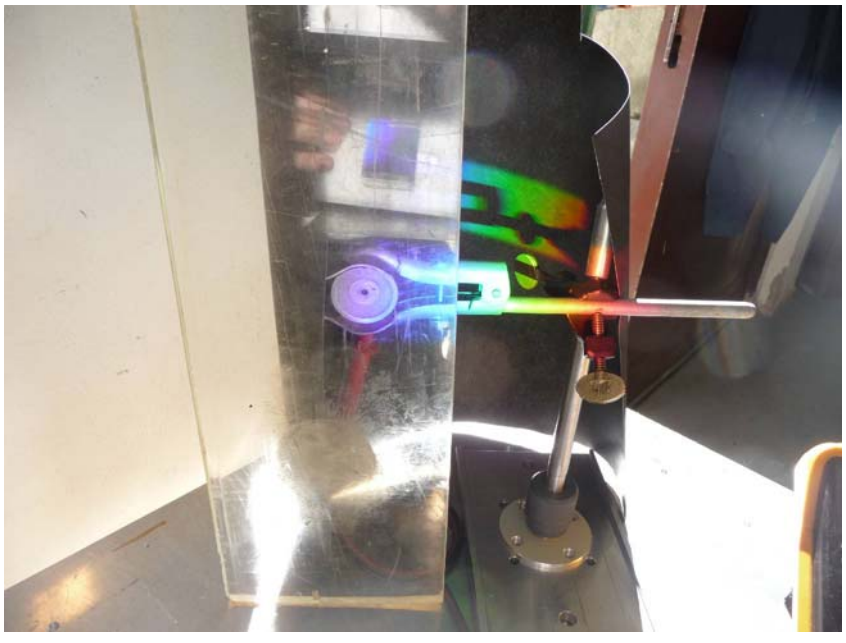

Photo 13.

Photo 14.

This fact allows using PMMA for protective windows for the HEAD.

Measurements of spectral sensitivity of UV/Blue LED with an artificial broadband radiation source (60 W Tungsten Lamp) carry out in summary spent. The measurements results approximately repeated the curve depicted on a Fig. 1, but with the smaller amplitude of a signal. So, the signal from a lamp in an integrated mode has made nearby 0.2 V. With diffraction grating in 1° - order at 460 nanometers the spectral response of the Detector has approximately 0.04 V. In the UV zone (near approx. 360 nm) the signal was approx. 0.03 V. "Redwave shifting" there were in green area approximately on the same of 560 nanometers. The signal has level – 1-2 mV. Here already it is necessary to tell about limit detection abilities of the Blue LED which is caused by insufficient energy of the utilized artificial source in the given part of a spectrum. Visual control of a spectrum has been complicated because of its low intensity.

4. Conclusions.

By results of similar semi quantitative measurements nevertheless it is possible to conclude that UV/Blue LED is narrow-band enough selective and effective detector in near UV and Blue area of a Spectrum. This data allows applying UV/Blue LED in the scheme of the optic-electronic comparator using a phenomenon of the big distinction of radiation flows from the top hemisphere (Sky-Sun) and the spreading terrestrial surface. Undoubtedly, similar optic-electronic sensor of a course/apogee (**HEAD**) can be used with success on rockets of an experimental class with a ceiling 0.1 - 5 km. About what there are positive experimental data. Use HEAD at heights of the big 5000 m (up the clouds) demands the further experimental research.