Geophysical Research Abstracts
Vol. 15, EGU2013-7133, 2013
EGU General Assembly 2013

GRASSP (GRAnada Sprite Spectrograph and Polarimeter). Design and implementation.

María Passas, Justo Sánchez, Francisco J. Gordillo-Vázquez, Alejandro Luque, and Francisco C. Parra-Rojas
Instituto de Astrofísica de Andalucía (IAA-CSIC), Glorieta de la Astronomía s/n, 18008 Granada, Spain

Transient luminous events (TLEs) are short optical emissions that occur in the upper atmosphere above storm systems. They appear between 15 and 90 km altitude and last between less than a millisecond to up to two seconds. So far there are no polarization studies of TLEs, nor high-resolution spectroscopy results which could help us to understand the kinetics and electrodynamics of these kind of optical emissions.

The GRASSP (Granada Sprite Spectrograph and Polarimeter) instrument has been developed to measure simultaneously the polarization and the spectra of the light emitted from these TLEs with medium spectral resolution (0.45nm). By consulting a real-time lightning database, the telescope aims automatically to the region of the sky where a TLE is predicted to appear. The instrument is located outside the 2.2 m dome of the German-Spanish Astronomical Center at Calar Alto, Sierra de Los Filabres, north of Almería (Andalucía, Southern Spain), at 2168 meters above mean sea level. From this location we can observe the western Mediterranean Sea zone (37º-45ºN; 2ºW-6ºE) with an elevation of 10º-35º above the horizon, a region where the most TLE activity in Europe takes place. GRASSP is a prototype which consists of a spectrograph and a polarimeter, both installed on a telescope mount.

The 6-channel imaging polarimeter will cover a spectral range from 500 – 750 nm, with a polarized / unpolarized sensitivity smaller than 5 %. It will present a circular field of view of 5º and a CCD of 2000 $\times$ 2000 pixels with a FOV of 15 μm/px. The goal is to find the 4 Stokes parameters in a single shot. To do so, the polarimeter consists of seven circular windows disposed over a telescope surface, six of them are located around the border of the circle and the last one is located in the center. This single window will show the unfiltered image and the six remaining ones include a different polarizer (0º 45º 90º 180º linear polarizers and left and right circular polarizers). This polarimeter is presently under development, so only preliminary results will be shown.

The spectrograph is operative since 21st November 2012. It uses a 1440-lines/mm grating and presents a variable free spectral range of 110 nm (655 nm to 765 nm), with a spectral resolution of R = $\lambda/\Delta\lambda$ = 1500; $\Delta\lambda$ = 0.45 nm. It uses an ICCD camera of 1360 x 1024 pixels with a FOV of 4º and 0.01 mm/px. The entrance slit ($\sim$100 microns) is oriented parallel to the horizon to optimize the likelihood of TLE detection. To verify that the detected signal in the spectrograph comes from a TLE, a high sensitivity field camera (WATEC camera) with a FOV of 30º was bore sighted with the spectrograph. Both cameras (ICCD and WATEC) operate at 25 frames per second. At the moment only the spectrograph is installed in GRASSP, working to find the first TLE spectrum from CAHA.