ROBOTIC SYSTEMS FOR THE DETERMINATION OF THE COMPOSITION OF SOLAR SYSTEM MATERIALS BY MEANS OF FIREBALL SPECTROSCOPY.

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Introduction: Meteoroids are mostly originated from asteroids and comets. The mechanisms that deliver these particles to Earth provide a unique opportunity to measure from the ground the physico-chemical properties of these Solar System materials. Meteor spectroscopy is a useful technique to study the chemical composition of these particles when they ablate in the atmosphere. Besides, the analysis of meteor spectra can provide useful information about the mechanisms that control this ablation process, but also about the chemical nature of the parent bodies of the corresponding meteoroids [1, 2, 3, 4]. For this reason we have developed since 2006 a network of autonomous CCD devices to image meteor spectra. This also involved the development of software for the analysis of the spectra but also for the autonomous operation of the recording devices. This research project, which has been partially funded by the University of Huelva, is named SMART, which is the acronym for Spectroscopy of Meteoroids in the Atmosphere with Robotic Technologies.

Instrumentation and methods: Our video spectrographs work in a fully autonomous way by means of software specifically developed in the framework of the SMART project. These slitless systems are based on the same low-lux CCD video cameras we employ since 2006 to monitor meteor and fireball activity [4, 5, 6]. The new higher-resolution spectral system consists of two slitless slow-scan high-sensitivity CCD devices that employ 1000 lines/mm diffraction gratings. They operate since August 2012 from Sevilla, where an array of high-sensitivity CCD video cameras is also used for the monitoring of meteor activity. The new spectrographs generate imagery in FITS files which are sent to GPS synchronized computers. The exposition time is adjusted according to the conditions of the sky. These systems are currently covering an extension of about 50ºx50º degrees in the night sky.

Preliminary results: Most of the meteor spectra recorded by us correspond to materials with chondritic composition, although achondritic meteoroids have also been recorded. Although most emission lines identified in these spectra correspond to Fe I multiplets, the contribution from the H and K lines of ionized calcium is typically detected. Other multiplets commonly identified are Ca I-2 (422.7 nm), Na I-1 (588.9 nm) and Mg I-2 (516.7 nm). The contributions from atmospheric N2 and O I are also seen.

Acknowledgements: This research has been partly funded by the Spanish Ministry of Science and Innovation and the Junta de Andalucía (projects AYA2009-13227 and P09-FQM-4555).

References:

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