Abstract

Most of the activity of the group is based on the Fireball Detection Station located at the Observatorio UCM, a network of similar stations covering the atmosphere over Spain.

This continuous monitoring during the last 2 years has resulted in the detection from the Observatorio UCM of 4 superbolides that occurred over Iberian Peninsula [Icarus 233 (2014): 27-35; MNRAS 436.4 (2013): 656-3662; LPI (2013) No. 1719, p.1055].


The products of the station have been used for undergraduate thesis projects at the Physics Faculty (e-prints UCM 13290) and other undergraduate projects. In 2013 the station received new equipment thanks to the Cartanen Arquimedes award, complementing the detection with spectroscopic and frame-integrating devices.

Superbolides research

Most of the stations operated by the UCM group run every night, as one of the main goals of the network is detecting superbolides. These bright fireballs (brighter than ~17 apparent magnitude) are very rare and completely unexpected. The detection and study of these events is the best tool to understand the origin and nature of the meter-sized population of meteoroids with orbits crossing the Earth orbit.

During the last 2 years our stations have recorded 4 superbolides flying over the Peninsula [Icarus 233 (2014): 27-35; MNRAS 436.4 (2013): 656-3662; LPI (2013) No. 1719, p.1055]. The combination of all the data coming from double station and multiple station recordings within the SPMN has led to the determination of the atmospheric trajectory, heliocentric orbit and other physical properties such as their preatmospheric mass and tensile strength.

Moreover some of the stations have spectroscopic capabilities. The use of diffraction gratings in the video cameras is essential to observe the differential absorption of the components of the meteoroids. The study of the composition of these particles is directly related to the nature of the parent bodies, providing valuable chemical analysis of many minor bodies.

Meteor showers monitoring

As part of the continuous monitoring performed by the video stations, many meteor showers are detected. Sometimes some of them are relevant enough to deploy some extra stations to do a detailed research of the shower or event. Some of these campaigns have been along several years (e.g., Perseids [LPI (2013) No. 1717, p.1159] or for some particular events as the 2011 Draconids outburst [MNRAS 433.1 (2013): 560-570; IMC Proc. (2012): 70-73], or the recent 2014 Camelopardalids outburst [In press]).

Balloon-borne missions

Since 2011 we have been sending high-sensitivity video cameras to the stratosphere on-board weather balloons. It improves detection efficiency thanks to much lower extinction. These experiments are much cheaper that the airborne missions that have been already organised for relevant meteor outbursts. At the moment we have already carried out missions for the Draconids 2011, Geminids 2012 [LPI (2013) No. 1719, p.2202] and Camelopardalids 2014, and we are prepared to do these launches on a regular basis for the major meteor showers.

Instrumentation

Part of the research of the group has been focused on instrumentation development at the Laboratorio for Scientific Advanced Instrumentation (Laboratorio de Instrumentación Científica Avanzada, UCM-UCM). The products of the station have been used for undergraduate thesis projects at the Physics Faculty (e-prints UCM 13290) and other undergraduate projects. In 2013 the station received new equipment thanks to the Cartanen Arquimedes award, complementing the detection with spectroscopic and frame-integrating devices.

One of the new elements is a Water: 910 H2 camera. It had never previously been used for meteor detection and the manufacturer claimed it to be more sensitive than the previous models. We carried out a sensitivity and spectral characterization, and compared it to our usual camera, the Water: 902 H2, that performed better.

The research in the instrumentation field has also been applied to the meteor detection in wide-field survey telescopes. In the new era of the time-domain astronomy, many telescopes will cover the whole sky with a cadence of a few days. These requirements lead to fast large telescopes with wide FOVs, like the Schmidt cameras that were widely used for meteor observing in the past. Our estimations show that meteor detection rates that will be achieved with the future wide-field survey telescopes are similar to the ones for current video cameras. Therefore, meteors detected as by-products in these surveys will be a free source of meteors data that could be easily exploited.