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Analysis of a North ω-Scorpiid fireball recorded by the Spanish Meteor Network on 2010

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Abstract

We report a very bright fireball recorded from two video stations working in the framework of the SPanish Meteor Network (SPMN) in Andalusia and Murcia regions. High-sensitivity CCD video cameras recorded the event and allowed the reconstruction of the atmospheric trajectory, velocity, and radiant determination. From such data the orbital elements of the meteoroid were obtained, finding a clear association with the North ω-Scorpiids meteoroid stream. The emission spectrum was also analyzed.

1. Introduction

During the end of May and mid June, meteor activity from the Scorpiid-Sagitariid complex can be noticed. One of the streams belonging to this complex is the North ω-Scorpiids (NSC), which was previously designated by some authors as the χ-Scorpiids [1]. This is included in the IAU Working list of meteor showers with the code 66 NSC. Its activity period goes from May 23 to June 15 with a maximum around June 1st. The Apollo-type orbit of NSC meteoroids let Drumond to propose 1862 Apollo as the parent asteroid of this meteor shower [2]. Nowadays, however, asteroid 1996 JG is included among the potential parent bodies of this stream [1].

We perform a continuous monitoring of the night sky from 25 meteor observing stations in Spain. Some of these employ CCD video devices with attached diffraction gratings to obtain the emission spectrum of meteoroids ablating in the atmosphere. In this context, on June 6, 2010 we have imaged a double-station NSC fireball with an absolute magnitude of about -10±1. The analysis of this fireball is made here.

2. Instrumentation

The stations involved in the detection of the North ω-Scorpiid fireball analyzed here (Sierra Nevada and La Murta, in the south of Spain) employ high-sensitivity 1/2" b&w CCD video cameras (Watec, Japan) endowed with fast aspherical optics. A detailed description of these systems has been done elsewhere [3, 4]. The CCD video cameras operating from Sierra Nevada work in an autonomous way by means of proper software [5] and have attached holographic diffraction gratings (500 to 1000 lines/mm) to record the emission spectra resulting from the ablation of meteoroids in the atmosphere. These provide chemical information about these particles of interplanetary matter.

3. Data reduction and results

The mag. -10 North ω-Scorpiid fireball analyzed here (SPMN060610) was imaged on June 6, 2010, at 23h18m38±1s UT from our Sierra Nevada and La Murta meteor stations (Fig. 1). The radiant and orbital parameters of the fireball are shown on table I. The preatmospheric velocity calculated from the velocities measured at the beginning of the meteor trail was V_∞=22.1 ±0.5 km/s. From the deduced orbital elements, by using our ORAS software (ORbital Association Software) we confirm that asteroid 1996 JG is the likely parent body of the North ω-Scorpiid stream. Thus, for example, by using the Southworth and Hawkins dissimilarity criterion, we obtain a value of Dsh of about 0.09 [6].

One of our cameras in Sierra Nevada also recorded the emission spectrum of this fireball. This raw spectrum is shown on Fig. 2, where the processed spectrum obtained by using the deinterlacing and the background removal filters implemented in our

recently developed CHIMET software is also included. As can be noticed, the second order spectrum could be also partially imaged. The spectrum has been calibrated by taking into account the spectral response of the detection device. Most prominent lines correspond to Ca II-1 (396.8 nm), Mg I-2 (516.7 nm) and Na I-1 (588.9 nm). Atmospheric oxygen lines can also be noticed.

Table 1: Radiant and orbital data (J2000) for the SPMN060610 fireball.

Radiant data			
	Observed	**Geocentric**	**Heliocentric**
R.A. (º)	252.5±0.2	251.7±0.2	-163.1±0.2
Dec. (º)	-7.42±0.05	-10.90±0.05	5.99±0.05
V_∞ (km/s)	22.1±0.5	19.0±0.5	36.0±0.5
Orbital parameters			
a (AU)	2.0±0.1	**ω (º)**	261.5±0.7
e	0.65±0.02	**Ω (º)**	76.1390 ± 10^{-4}
q (AU)	0.67±0.05	**i (º)**	6.9±0.3
Q (AU)	3.2±0.1		

Figure 1: mag. -8 Scorpiid fireball imaged from Sierra Nevada on June 6, 2010, at 23h18m38±1s UT.

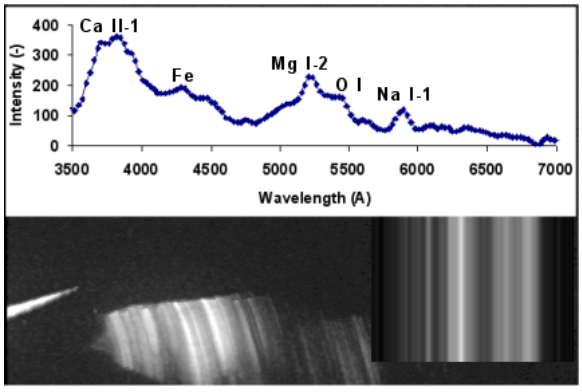

Figure 2: spectrum of the SPMN20100606 Scorpiid fireball.

4. Summary and Conclusions

A continuous monitoring of meteor and fireball activity over Spain and neighboring countries is obtaining valuable information on the origin and nature of very bright bolides. The Scorpiid-Sagitariid complex is an important source of bright bolides as nicely exemplifies the SPMN060610 bolide. From our video stations we have obtained radiant, orbital and chemical information from one member of the North ω-Scorpiids meteoroid stream. The analysis of the images recorded of the SPMN20100606 fireball confirms that the likely parent object of the North ω-Scorpiid meteor stream is asteroid 1996 JG.

References

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