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The Lyrid meteor shower in 2012

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Abstract

We present here the preliminary results obtained from the monitoring of the April Lyrids during its maximum activity peak in 2012. Precise radiant and orbital information was inferred from the multi-station trails recorded by high-sensitivity CCD video devices. Three emission spectra were also imaged. These have also provided clues about the chemical composition of the corresponding meteoroids.

1. Introduction

The accepted parent body of the April Lyrid meteoroid stream (LYR) is comet Thatcher (C/1861 G1) [1, 2]. These particles, which seem to be relatively old [3] encounter the Earth's orbit from about April 16 till April 25, giving rise to a display of meteors with a maximum activity around April 21-22. The Lyrids were known to produce outbursts with a period of about 60 years, and it was suggested that this was due to the fact that the swarm could be trapped in the 1:10, 1:11 and 1:12 mean-motion resonances with Jupiter [3]. However, on the basis of less well documented outburst other researchers claimed that this period could be of about 12 years [4]. Thus, the determination of precise orbital and radiant information can be very useful to improve our knowledge about this cometary swarm. With this aim we have monitored this shower during its maximum activity period in 2012. Optimal astronomical and weather conditions favored this observation campaign. The New Moon and clear skies in Andalusia made possible the multi-station monitoring of this shower from three of our SPMN meteor observing stations in that region (Sevilla, Arenosillo and Sierra Nevada). Our station operated from La Hita Astronomical Observatory, in central Spain, was also operative. As a result of this, over 30 multi-station trails were recorded. Besides, as a result of our continuous spectroscopic campaign 3 emission spectra were obtained. The preliminary results obtained so far are presented here.

2. Instrumentation

As imaging devices we have used an array of high-sensitivity monochrome CCD video cameras (models 902H and 902H Ultimate from Watec Corporation, Japan) running in PAL mode (25 fps, 720x576 pixels). The four SPMN automated meteor stations involved in the observation of the Lyrids employ between 5 to 9 of these devices. The common atmospheric volume monitored from the different locations is maximized by arranging these cameras in an optimal way. A detailed description about how these video stations are operated has been given elsewhere [5, 6]. These systems are very useful to obtain radiant and orbital data, but we are also developing a continuous spectroscopic campaign by using holographic diffraction gratings (1000 lines/mm) attached to some of our cameras. In this way we can also infer information about the chemical composition of these particles of interplanetary matter [7, 8, 9, 10].

3. Data reduction and results

Over 30 Lyrids were simultaneously recorded from at least two of our meteor observing stations on April 22, 2012. The maximum activity took place between 03h50m and 04h10m UT, and a value of the ZHR of 20±4 was obtained. The magnitude distribution index, calculated from 20 meteors brighter than mag. 3, yields r=2.5±0.6. The averaged apparent radiant was located at R.A.: 276.1 ± 0.8 º, Dec: 35.5 ± 0.7 º.

Multi-station trails were automatically identified among the images recorded from every meteor station by means of our MetComp software. Then, these data were reduced with the Amalthea software [11], which employs the planes intersection method to obtain the atmospheric trajectory of the meteors, but also the radiant and the orbital elements of the meteoroids. These parameters, averaged for 7 double-station Lyrids, are summarized in Table 1. As can be noticed, an averaged value of 47.3±0.4 km/s was obtained for the preatmospheric velocity.

Table 1: Averaged radiant and orbital parameters (J2000) for 7 Lyrids.

Radiant data			
	Observed	**Geocentric**	**Heliocentric**
R.A. (º)	276.1±0.8	275.6±0.8	-
Dec. (º)	35.5±0.7	35.5±0.7	-
V_∞ (km/s)	47.3±0.4	45.8±0.5	41.1±0.5
Orbital parameters			
a (AU)	10.6±5.1	**ω (º)**	206.5±3.7
e	0.91±0.03	**Ω (º)**	32.226±0.001
q (AU)	0.95±0.01	**i (º)**	78.7±1.9

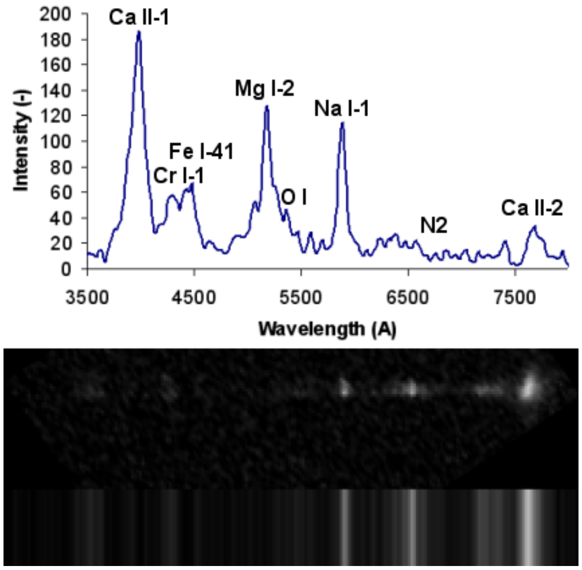

Figure 1: Raw and processed emission spectrum of the SPMN220412b LYR fireball.

The emission spectrum were obtained for the three brightest LYR bolides recorded from Sevilla, La Hita and Sierra Nevada. These were calibrated in wavelength by means of typical metal lines (Ca, Fe, Mg, and Na multiplets) and then corrected according to the efficiency of the imaging device. Fig. 1 shows the raw and processed spectrum for a mag. -7±1 fireball simultaneously imaged from La Hita and Sierra Nevada on April 22, at 2h19m33.4±1 s. UT (SPMN code 220412b). The most remarkable lines correspond to Ca II-1 (396.8 nm), Cr I-1 (425.4 nm), Fe I-41 (441.5 nm), Mg I-2 (516.7 nm) and Na I-1 (588.9 nm) multiplets. Several atmospheric oxygen and nitrogen lines have been also identified.

6. Summary and Conclusions

We have monitored the April Lyrids during its maximum activity period in 2012. Optimal weather and astronomical conditions favored the observation of this shower from several of our meteor stations in Andalusia and central Spain. The radiant and averaged orbit has been calculated from the analysis of 7 multi-station events. Fireball activity was also recorded and three emission spectra were imaged. These have provided chemical information for meteoroids belonging to this cometary stream.

Acknowledgements

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References

[1] Weiss, E. 1867, Astron. Nachr., 63, 382.

[2] Galle, J. 1867, Astron. Nachr., 69, 33.

[3] Jenniskens, P. (2006) *Meteor Showers and their Parent Comets.* Cambridge University Press.

[4] Arter, T.R. and Williams, I. P, MNRAS, 286, 163-172, 1997.

[5] Madiedo, J.M. and Trigo-Rodríguez, J.M. Earth, Moon, and Planets 102, pp. 133-139, 2007.

[6] Madiedo, J.M., et al., Advances in Astronomy, Vol. 2010, 1-5, 2010.

[7] Trigo-Rodriguez, et al. MNRAS. 392, 367–375, 2009.

[8] J.M. Trigo-Rodríguez et al. MAPS 38, 1283-1294, 2003.

[9] Trigo-Rodríguez et al. MNRAS 348, 802-810, 2004.

[10] Borovicka, J. Astron. Astrophys, 279, 627-645, 1993.

[11] Trigo-Rodriguez J.M. et al. MNRAS 394, 569-576, 2009.