Camelopardalids expedition

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This paper describes preliminary results of the Polish Fireball Network expedition to observe the outburst of the particles stream of comet 209P/LINEAR. According to the theoretical calculations the predicted shower radiated from Camelopardalis constellation and reached its maximum on May 24th 2014. The selection of observation sites and equipment is presented. Eleven analog cameras, digital cameras and DSLR cameras were used in the double station observing system. As a result 174 meteors were recorded, 32 of them were Camelopardalids. Using data from the maximum night the 15 orbits of meteors were calculated – 5 orbits have orbital parameters similar to the expected values for Camelopardalids.

1 Introduction

209P/LINEAR was discovered on February 3rd 2004 by *Lincoln Near-Earth Asteroid Research* (LINEAR). The comet orbit gets close to the Earth's orbit and further analysis showed possibilities for an increased meteor activity from this comet on May 24th 2014. A number of authors presented models according to which the maximum number of meteors could be seen between 6^h00^m and 8^h00^m UT (Table 6j of Jenniskens 2006; Vaubaillon 2012[1]; Jenniskens and Lyytinen 2014; Ye and Wiegert 2014). The radiant of these meteors is located in the constellation of Camelopardalis.

Figure 1 – Logo of Camelopardalids expedition by P. Zaręba.

Because of the possibility to observe meteors from this comet, confirmed by many independent analyzes, we decided to prepare an expedition with three persons (authors of this paper) to observe the Camelopardalids. The logo of the expedition is presented in *Figure 1*.

[1] http://www.imcce.fr/langues/en/ephemerides/phenomenes/meteor/DATABASE/209_LINEAR/2014/index.php

2 Expedition

The choice of the observation place

The time of the expected maximum activity was unfavorable for European observers. At about 7^h00^m UT on May 24th the Sun is above the horizon and prevents the registration of meteors by the Polish Fireball Network cameras. Analyzing all options for the best place to watch the outburst we took into account:

- the height of the Sun below the horizon at the moment of the maximum;
- the height of radiant at the moment of the maximum;
- moment of Moon rise;
- the length of the night.

These criteria limited the area of potential observations to the vicinity of the border between Canada and the United States. Further factors which were taken into account were:

- the darkness of the sky;
- weather statistics;
- the possibility of tornadoes;
- the probability of the aurora borealis occurrence;
- the cost of transport and accommodation;
- the ability to work with local observers of meteors;
- the necessity to have a visa (USA);
- the easiness to carry the large amounts of equipment across the border.

None of the members of the expedition had a US visa. In order to avoid additional costs and complications we chose for an expedition to Canada.

We were able to find a direct cheap flight connection from Poland to Toronto. Thanks to the information obtained from Prof. P. Brown we have selected the area of Tobermory, Bruce Peninsula as the likely darkest

place, away from areas of frequent tornadoes. It is also in close proximity to an active fireball network conducted by the University of Western Ontario.

In the neighborhood of Tobermory we were able to rent a house that perfectly suited our purposes (*Figure 2*). The house had two balconies facing south-east, one of them was a spacious terrace with a wide field of view. This place had become our base and the first observing point (A).

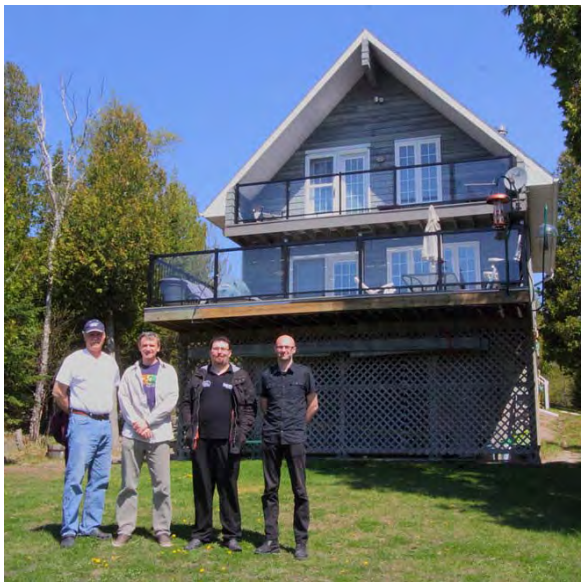

Figure 2 – Willow Bank house near Tobermory, base of expedition and location of the first station (A). On the picture: Glenn Aishford (owner of the house), Zbigniew Tymiński, Przemysław Żołądek and Mariusz Wiśniewski, members of the Camelopardalids expedition.

With the help of Prof. P. Brown and Z. Krzeminski we contacted The Fox Observatory. This place was used as a second observation point (B).

Figure 3 – Analog cameras used during the expedition.

Cameras and field of view selection

As a result of the preparation we had selected 12 cameras which we selected for the expedition. Observations were carried out at two stations in order to determine the trajectory and orbit of recorded phenomena. Analog CCTV cameras used during the expedition are displayed in *Figure 3*.

The most sensitive analog cameras were used to create two pairs with similar field of view. The first pair was based on a 6mm lens and the other on a 8 and 9mm lens (see *Figure 4*). These were the very fast lenses.

Watec cameras with wide angle 3.8mm lens worked in pair with a digital camera ZWO ASI 120MM lens 1.8mm.

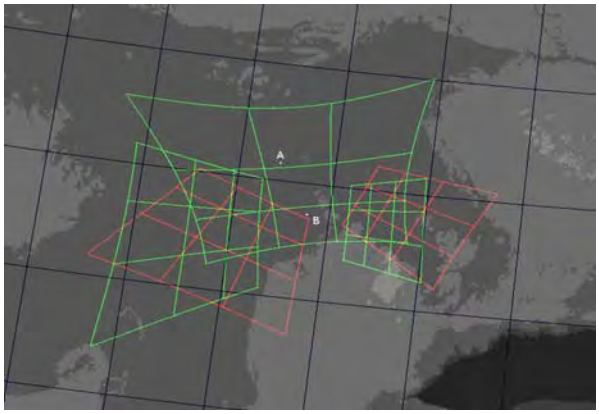

Figure 4 – Field of view of analog cameras used for doublestation observations.

One DSLR has been used for wide-angle observations of the brightest meteors. One analog camera has not been used. The signal from three analog cameras was recorded entirely on DVRs for further analysis. The image of the other three cameras was analyzed in real time.

3 Results

A summary of the number of registered events has been presented in *Table 1*. The number of Camelopardalids remained significantly below the expectations, but no doubt, they were distinguished among other meteors. It has turned out that the most effective instrument were a pair of cameras with 6mm lenses. The ZWO 120MM camera with the Fujinon 1.8mm was most effective in capturing Camelopardalids (see *Figure 5*). Cameras with a smaller field of view were significantly less effective. No meteor spectra have been recorded.

Using the data from the maximum night, 15 meteor orbits were calculated. 5 orbits have orbital parameters similar to the expected values for Camelopardalids.

For spectroscopic observations the PointGrey BlackFly 09 M digital camera, two Canon digital SLR cameras, and one Tayama C3102-01A1 analog camera were used.

4 Conclusion

The maximum of Camelopardalids proved the accuracy of the modeling of meteoroid streams. The Earth crossed the stream of meteoroids at the time it was expected. The number of meteors from this stream was much smaller than expected which greatly reduced the number of registered and calculated meteor trajectories.

The expedition was a very important experience. With well-prepared equipment, all components worked as

Table 1 – Summary of the results

Camera	Lens	Loc.	Meteors	CAM
MINTRON 12V6	Panasonic 0.75/6mm	A	44	7
MINTRON 12V6	Computar 0.8/6mm	B	36	5
MINTRON 12V6	Tokina 1.3/8mm	B	12	4
WATEC Ultimate	Panasonic 0.75/9mm	A	17	2
WATEC Ultimate	Computar 0.8/3.8mm	B	16	2
ZWO ASI120MM	Fujinon 1.4/1.8mm	A	29	12
PointGrey BlackFly 09 M	Tamron 1.0/3-8mm (Spectra)	A	20	3
Tayama C3102-01A1	Ernitec 1.2/8mm (Spectra)	A	0	0
Canon 550D	Canon 3.5/10-20mm	B	1	0
Canon 1000D	Porst 1.8/35mm (Spectra)	A	0	0
Canon 1000D	Danubia 2.8/35mm (Spectra)	A	0	0
TOTAL			174	32
Orbits			15	5

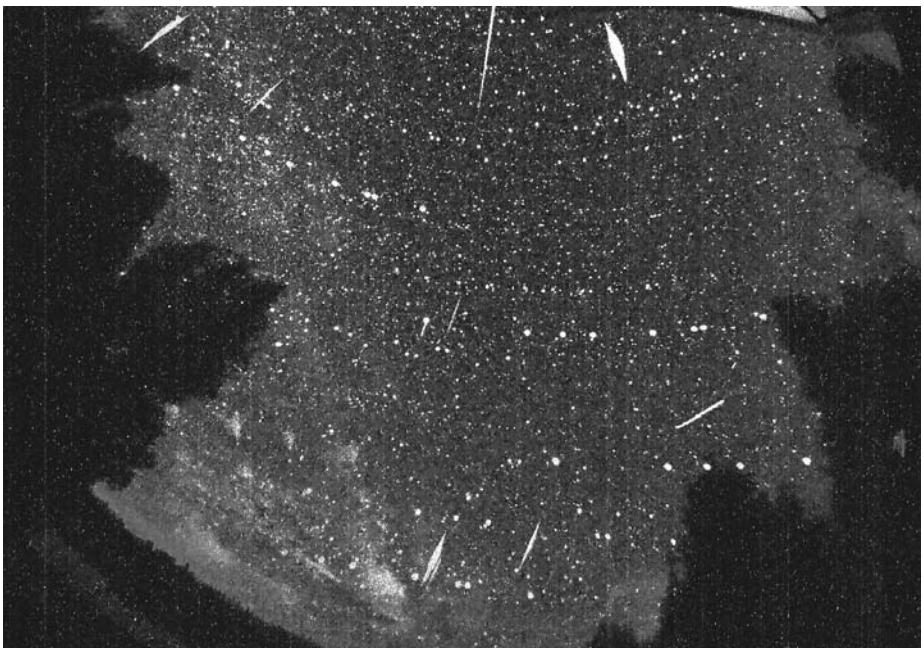

Figure 5 – Camelopardalids captured by the ZWO ASI 120MM camera with a Fujinon 1.4/1.8mm lens.

expected. Luckily the weather was perfect for observing at both locations.

The collected data will be used for more detailed analysis.

Acknowledgment

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