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Spectral variability in Draconid meteors

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Abstract

Draconid meteors show variable patterns in the Na/Mg line intensity ratios, both from meteor to meteor and in single meteors as a function of time.

1. Introduction

Observation of Draconid meteor spectra was performed during the 2011 outburst in scope of the double station observation campaign organized by the Czech team in Northern Italy [1]. We used a 600 grooves/mm transmission grating, 2/85 Jupiter lens, second generation image intensifier Mullard XX1332 and Panasonic S-VHS camcorder. The best five spectra were selected for the analysis.

2. Description of the spectra

Draconid spectra were observed previously [2, 3] and we could expect the new spectra to be dramatically different. Nevertheless, our spectra have relatively good resolution and extent to the near infrared. Similarly to the Leonid spectra [4], Draconid spectra consist of broad continuum, nitrogen molecular bands, and atomic lines of both meteoric (Ca, Fe, Mg, Na) and atmospheric (O, N) origin. The atmospheric emissions (O, N, N_2) are fainter than in Leonids, clearly as a consequence of much lower entry velocity (24 km/s instead of 71 km/s). When integrated along the trajectory, the ratios of Mg, Na, and Fe lines would classify Draconids as meteors of normal composition [5]. The most interesting aspects of Draconid spectra are the changing line intensities along the meteor trajectories, in particular of the Na line (the brightest line in Draconids) in comparison with the Mg line (the second brightest). The fact that the Na line starts and ends higher in some Draconids [2, 3] as well as Leonids [4] has been already known. Nevertheless, our new spectra (Figs. 1 and 2) show other interesting aspects and significant differences from meteor to meteor.

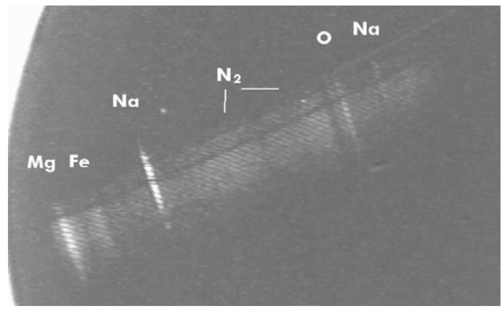

Figure 1: Draconid spectrum no. 4 (20:05:35 UT). Individual video frames were co-added. The meteor moved from upper left to lower right. Wavelengths increase from lower left to upper right. The blue part of the spectrum (below 500 nm) was out of the field of view. Note than one row of data is missing due to technical problems.

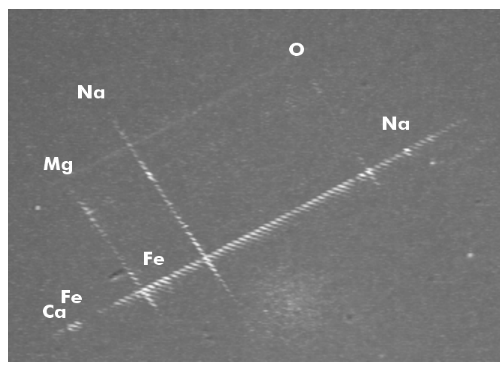

Figure 2: Draconid spectrum no. 6 (20:28:21 UT). Individual video frames were co-added. The meteor moved from upper left to lower right. Wavelengths increase from lower left to upper right.

In spectrum no. 4 (Fig. 1), the Na line appears first and then weakens earlier than other lines. But after disappearing, it reappears shortly again, forming a brief flare. This flare is not seen in any other line.

The spectrum no. 6 (Fig. 2) is completely different. The meteor shows one flare in the first half of the trajectory and another one, much brighter, in the second half. The Na line is the brightest line along the whole trajectory and it is well visible until the very end, long after the flare.

3. Interpretation

The different behavior of meteoroids of similar mass belonging to the same shower indicates significant differences in the structure of the meteoroids from the same parent comet. We plan to perform detailed analysis not only of the spectra but also of the decelerations and morphologies of the corresponding meteors. Our earlier work showed that Draconid meteoroids are composed of grains of various sizes [3]. Larger meteoroids presented here evidently have more a complicated structure.

References

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