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Properties of the Leonid meteoroids of different age

P. Koten

Astronomical Institute, Ondrejov Observatory, Ondrejov, Czech Republic, (koten@asu.cas.cz / Fax: +420-323-620263)

Abstract

1. Introduction

The activity of the Leonid meteor shower strongly depends on its parent comet. The comet 55P/Tempel-Tuttle passed through the perihelion in 1998 and subsequently strong meteor storms occurred in 1998 to 2002 [2]. After this period the activity decreased again but two other small outbursts were observed in 2006 and 2009 [4]. Since in all of these cases our planet encountered stream filaments with different time of ejection from the comet, the observations provided us with the opportunity to study properties of the meteoroids with different age. In this paper we investigate atmospheric behavior of Leonid meteors and compare different filaments of this meteor shower.

2. Observational data

We carried out the double station video observations of the Leonid meteor shower in 1998, 1999, 2000, 2001, 2006 and 2009. This collection of the data contains very young material ejected from the parent comet only 2 revolutions ago (observed in 2006) as well as old material, which left the comet in 1466 (observed in 2009). Table 1 contains summary of all the collected double station data.

Table 1: Summary of recorded data

Year of observation	Year of ejection from comet	Number of double station meteors
1999	1899	77
2000	1866	80
2001	1767	361
2006	1932	28
2009	1466	55

All the data were obtained by image intensifier video cameras, which were deployed on two different stations for each observational period. The configuration of the double station experiments was very similar. Also the used instrumentation was similar in all cases.

3. Atmospheric trajectories

Physical properties of the meteoroid influence the atmospheric trajectory of the meteor, especially its beginning and terminal heights. In the case of the cometary showers the beginning height usually depends on the photometric mass of the meteoroid [3]. Therefore we investigated this property and made comparison among different filaments of Leonid shower. As Figure 1 shows the slope of this dependence is different for each shower filament.

When we compare slope *k* for each filament with its age (number of revolution since the ejection), we receive a plot suggesting that older material produces higher slope of above mentioned dependence.

Since the value of the beginning height is influenced by different zenith distance of the meteor radiant, we checked this result also using Ceplecha's parameter K_B, where this potential effect is eliminated [1]. Again we received clear dependence of K_B on photometric mass, where K_B decreases with increasing mass. Therefore we can say that radiant effect does not influence the results.

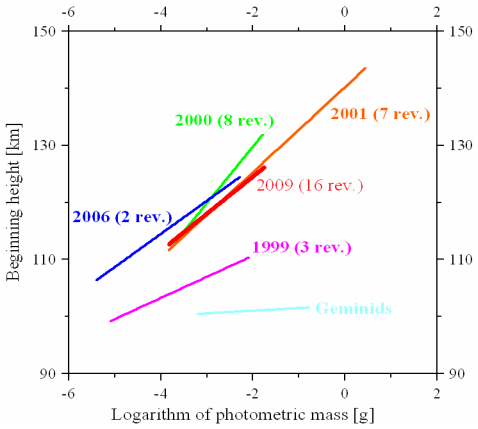

Figure 1: Beginning heights of different Leonid filaments as a function of the meteor photometric mass. For comparison the Geminid meteor shower is also shown.

4. Summary and Conclusions

We have found that the dependence of the meteor beginning height on its photometric mass differs for different filaments of the Leonid meteor shower. It seems that older material, i.e. the material which was ejected from the parent comet earlier, produce meteors with steeper slope of this dependence than material younger. This would support the idea that older meteoroids are more fragile due to longer exposure to the cosmic environment influences.

Acknowledgements

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