Characteristics of the 2012 Geminids

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Abstract

The fluxes and ZHRs from the 2012 Geminid meteor shower as seen in NASA's Meteoroid Environment Office's wide-field meteor cameras are presented, as well as meteoroid densities as found using the meteor's light curve and deceleration.

1. Introduction

The parent of the Geminids, 3200 Phaethon, is a unique body in that it is classified as an asteroid, but is responsible for one of the most prolific meteor showers of the year, and has shown comet-like behavior in its past [1]. The Geminid meteor shower is also anomalous because its rates have been increasing since it was first detected. Understanding the composition and properties of meteoroids that belong to this meteor shower is an important area of study and of interest to both theoreticians and experimentalists.

2. Equipment and Methodology

NASA's Meteoroid Environment Office established two wide-field meteor cameras to observe meteors in the milligram-mass-range. Each camera consists of a 17 mm focal length Schneider lens (F/0.95) on a Watec 902U2 Ultimate CCD video camera, producing a 21.7x15.5 degree field-of-view. This configuration sees meteors down to a magnitude of +6. Data from these cameras are currently being used to calculate daily meteor fluxes automatically.

3. Results and Conclusions

On the first night of operation, December 13-14, 2012, 23 double-station and 53 unique single-station Geminids were detected. The flux density over the night was 0.038 meteors/km^2/hour down to a limiting magnitude of +6.5, for the double-station results and 0.034 and 0.043 meteors/km^2/hour for the single-station results. This corresponds to ZHRs between 66 and 84. Included in the flux algorithm is a process to find the collecting area per height and a method to find the limiting meteor magnitude in each 10 minute time period.

Using the light curves and decelerations of ten of these double-station Geminids, densities were estimated using a model of meteoroid ablation by Campbell-Brown et al. [2] which employs thermal disruption to model the release of grains during ablation. Bulk densities of Geminids give unique insight into the composition of Phaethon that would only otherwise be available by going to the asteroid itself. The bulk densities of these ten Geminids were typically between 2.6 and 3.3 g/cm^3, supporting previous studies [3][4], which prove Phaethon has a much lower porosity than most other meteor shower parents.

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