Observations of the Perseids 2015 using the SPOSH cameras

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INTRODUCTION

A series of meteor observation campaigns are organized by the Technische Universität Berlin (TUB) in collaboration with the German Aerospace Center (DLR) on an annual basis to study the Perseid meteoroid stream. Perseid meteors can been seen from late July until mid of August with the maximum of activity occuring on the 12/13th of August each year. Since 2009, double station observations are carried out from remote, mountainous areas located at the Peloponnese peninsula in southern Greece. The expected good weather conditions in this area during summer time and the lack of light pollution make the sites ideal for meteor observations. This year we recorded meteor activity from 8th until 13th of August using the Smart Panoramic Optical Sensor Head camera system (SPOSH) from two stations, one at Mt Parnon and the other at Mt Mainalon (Fig. 1). The expedition anticipated high meteor rates of the Perseids, favored by the absence of the Moon.

Fig. 1: Setting up the SPOSH camera system at Mainalon site

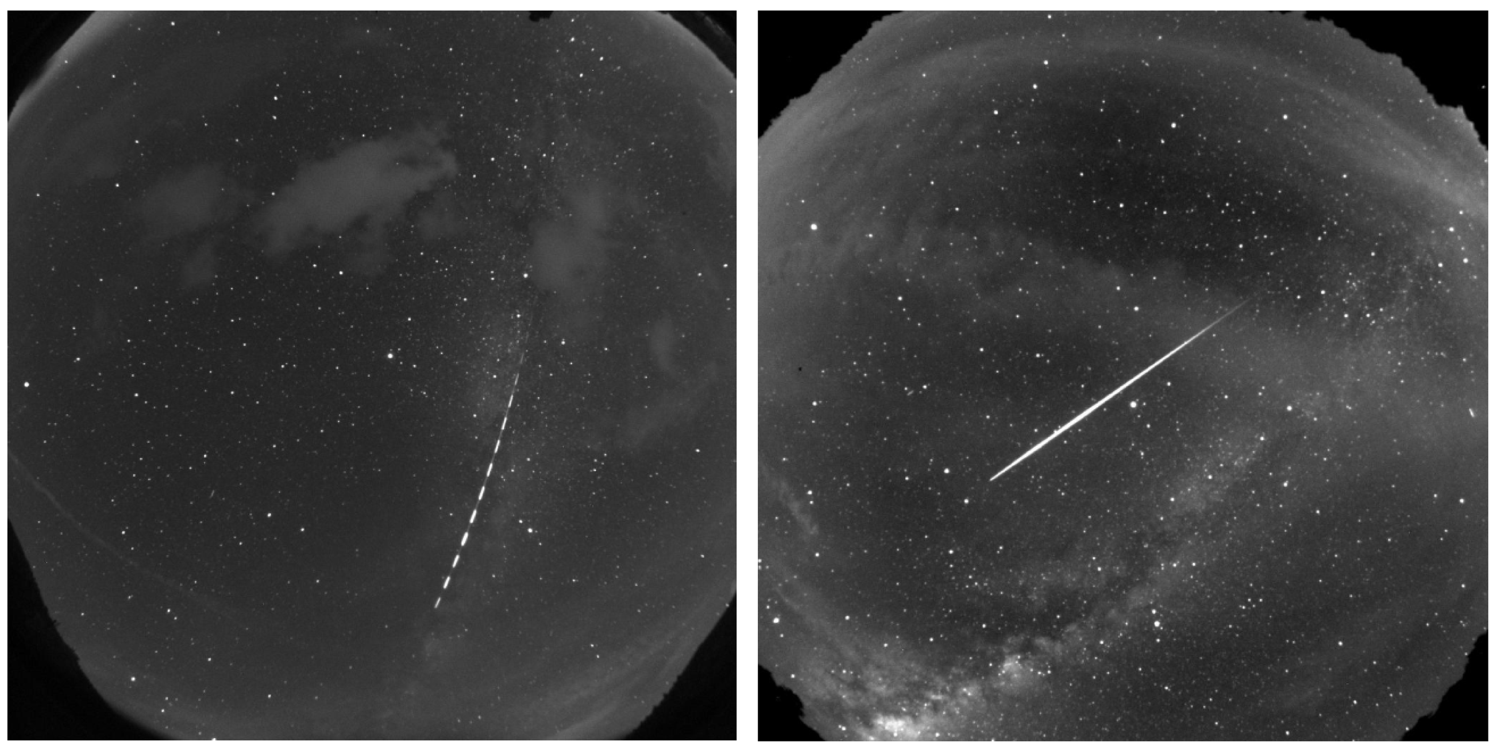

Fig. 2: Perseid meteor captured on the 12th of August 2015 at 19:39:36 UTC at Mainalon (left) and Parnon stations.

PROCEDURE

SPOSH cameras [3] were set up at the two stations and used to take images of the night sky at a rate of one image every two seconds. The cameras were fixed on a tripod stand. The quality of the acquired images depends strongly on the weather conditions during each night (i.e clouds and humidity). Meteor image data from two stations are needed in order to compute the trajectories of meteors seen simultaneously from both stations. Image acquisition began every evening at 9:30pm local time and continued until dawn. The raw data acquired from both cameras were processed at TUB using IDL-based software packages. We searched for meteors using an automatic search algorithm in the first instance, then complemented it with visual inspection of the images. The search algorithm detected 82% of the visually identified meteors, with 15% of the detections being false. Afterwards, meteors recorded from both stations were found by checking the time of occurence. Finally, their trajectories and velocities were computed, after computing the interior and exterior orientation of the cameras using star images [1].

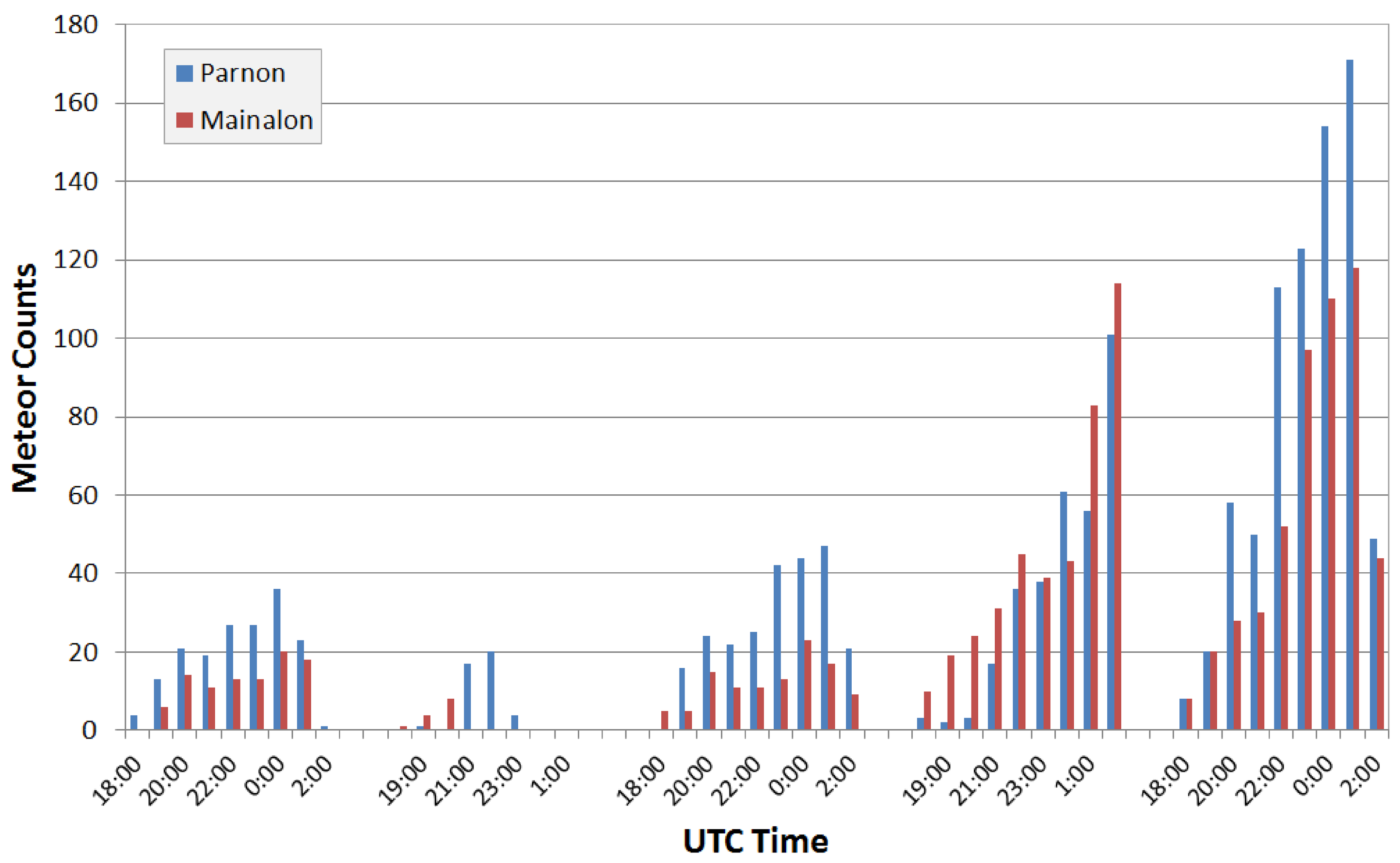

Fig. 3: The number of identified meteors per hour in Mainalon and Parnon stations from 8th until 12th (from left to right). During the early morning hours of the 12th of August, both stations recorded a high number of meteors. The use of a rotating shutter for the estimation of the meteors' velocities at Mainalon station resulted in a reduced number of meteors (see Results). The second day was overcast leaving both teams with a few hours of observations.

RESULTS

We detected 2415 meteors out of which 1416 meteors were recorded at Parnon and 885 at Mainalon station (Fig. 4). A high meteor activity was observed between 02:00 and 02:15 on the 12th of August, a day earlier than the expected peak, with nearly 100 meteors recorded at each station. The image positions of 1145 meteors in data acquired in Parnon (81%) and 629 in Mainalon (71%) were computed by the custom-made astrometric algorithm. The difference in the efficiency of the algorithm for the two datasets is caused by the use of a shutter which, for meteors with small angular velocities, reduces the length of the (illuminated) meteor trail to just a few pixels. From 400 double-station meteors the trajectories of 317 were computed (Fig. 4), the remaining 20% producing possibly spurious results and therefore were neglected. After comparing the radiant positions and velocities of the processed meteors with nominal values for the Perseid meteor shower, 139 meteors were identified as Perseids with their positions ranging from 35 to 55 degrees in right ascension and from 52 to 62 degrees in declination. Their positions were measured with a standard deviation of ±0.32° in right ascension and ±0.17° in declination. A cluster of meteors was found in our data by relating beginning heights and velocities (Fig. 6). The plot shows that fast-moving meteors start to ablate higher in the atmosphere, since the radiation process is being sped up by to the high velocity of the meteoroid [2]. The mean values of 115±4 km and 57±2 km/s for the beginning height and velocity indicate their asscociation to the Perseid meteor shower.

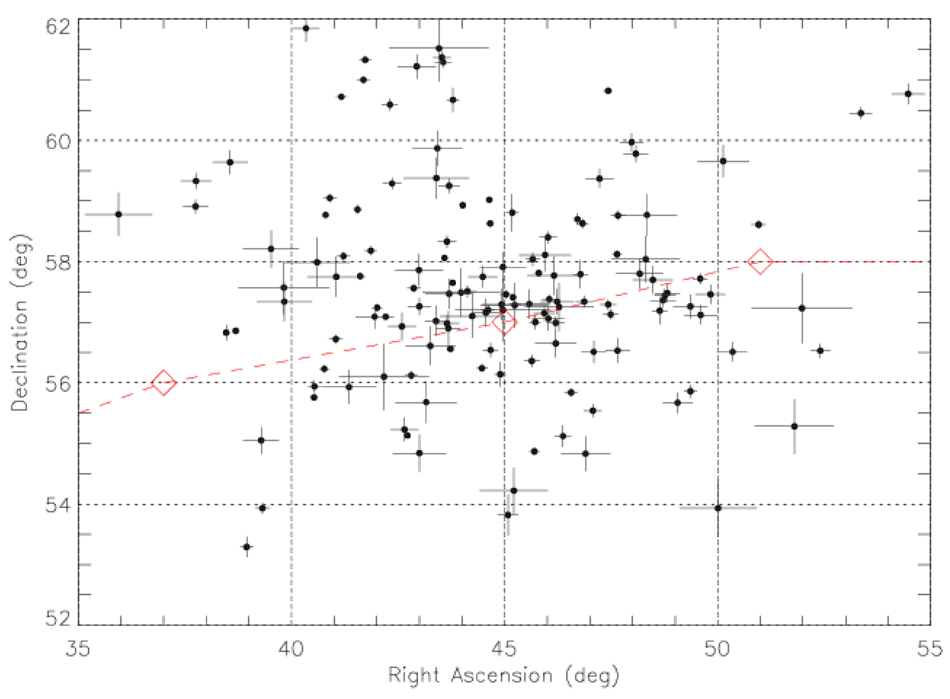

Fig. 5: Apparent radiant positions of meteors with similar velocities (52 - 62 km/s) to the Perseid meteor stream. The red dashed line represents the Perseids' radiant drift due to Earth's changing orbital velocity vector. The diamonds show the position of the radiant on the 5th, 10th and 15th of August (moving from left to right) as observed over the previous years by the International Meteor Organisation (IMO).

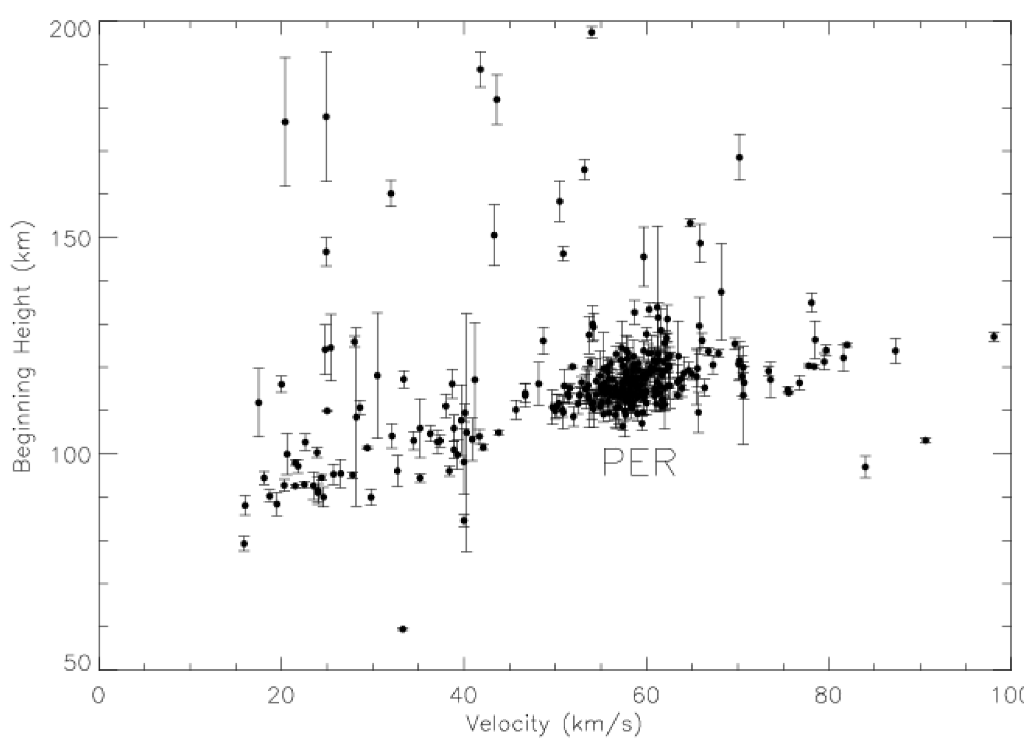

Fig. 6: A plot showing the beginning heights of meteors as a function of their velocities. The Perseid meteors cluster around a mean beginning height of 115 km and a mean velocity of 57 km/s. Two other minor groups can be seen having lower velocities.

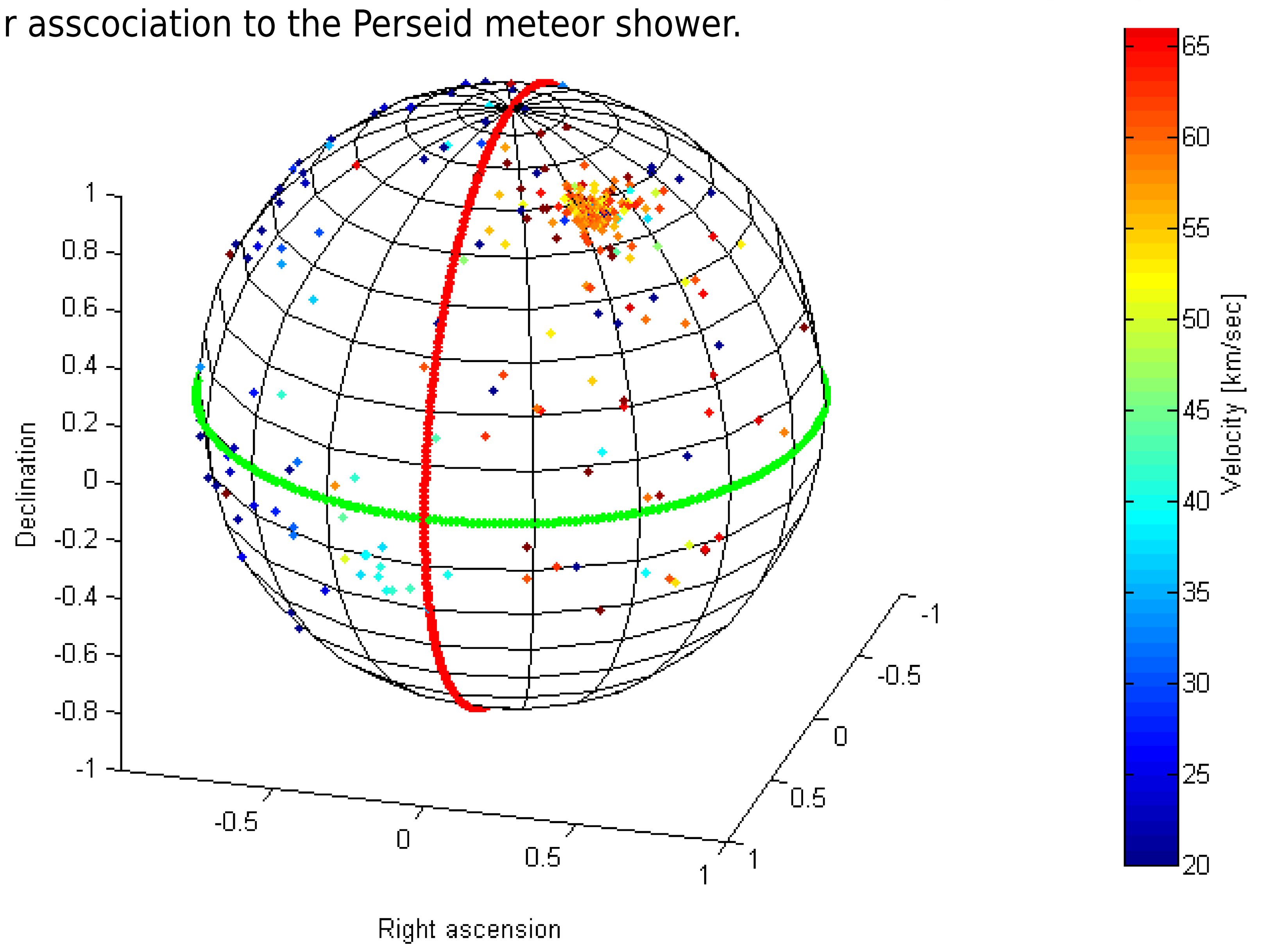

Fig. 4: Apparent radiant positions of 371 double station meteors with their velocities color-coded. The equatorial coordinates of the radiants were transformed to a normalized cartesian coordinate system and the positions were projected on a sphere. The green line represents the Earth's equator whereas the intersection of the red and green line shows the position of the vernal equinox.

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ACKNOWLEDGEMENTS

We would like to thank Vaggelis Tsamis and Kyriaki Tigani from the Astronomical Union of Sparta, as well as the Greek Hiking Clubs of Tripolis and Sparta. This research has been supported by the Helmholtz Alliance ROBEX.