

# Meteor activities within Europlanet

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The Europlanet project (<http://www.europlanet-ri.eu/>) is being carried out under the Seventh Framework Programme (FP7) of the European Union with the aim to increase the productivity of planetary projects, improve European scientific expertise in relevant research areas, and increase overall knowledge of planetary environments. The Europlanet Research Infrastructure links planetary scientists from more than 100 laboratories in Europe and around the world. The project helps planetary scientists to get the best out of their research by organizing networking activities, meetings and conferences, providing access to laboratories and field sites in Europe, developing new facilities, and creating online access to planetary science data. This unique and innovative strategy has been developed in the frame of the Europlanet project with emphasis on maximizing synergies between different fields contributing to Planetary Research: space and Earth based observations, data reduction, laboratory experiments, numerical simulations and modelling. The project is now in its final year and many of the goals have been achieved. The purpose of this report is to highlight Europlanet activities involving researchers interested in meteors.

Meteor activities within Europlanet cover quite a wide area:

- continued participation in the European Fireball Network activities

- regular Perseid meteor observation campaigns (2009, 2010, 2011, 2012)
- development of data reduction software
- set-up and testing of digital meteor station(s)
- software development for digital meteor stations
- development of a prototype Lunar impact flash observatory
- development of the Virtual Meteor Observatory (VMO), an archive for meteor observations
- student education and training
- participation in Europlanet-RI NA2 Expert Exchange Program

The Technical University of Berlin (TUB) and the German Aerospace Center (DLR) organize international meteor observing campaigns every summer focusing on the Perseids meteor shower. Since 2009, double station observations have been carried out in the Peloponnese peninsula in Greece, involving master's students and local amateur astronomers. Currently, a meteor dataset covering the whole activity period of the Perseid meteor shower between 22nd of July and 20th of August has been acquired. The observations were made using the Smart Panoramic Optical Sensor Head (SPOSH) [1], a camera is designed to image faint, short-lived phenomena on dark planetary hemispheres. Due to the high sensitivity of the camera's sensor and the custom-made wide-angle lens, the camera has been successfully operated during our observing campaigns. In 2012 the post-maximum activity of the Perseids was monitored from 15th to 20th of August, favoured by the new Moon on the 17th. The reduction of the meteor data was done automatically using software which has been developed at TUB and DLR. At present, the trajectories and orbits of 284 meteors have been computed [8].

The meteor data reduction software has been optimized and extensively tested with data acquired in 2011 during the Perseids observation campaign funded by Europlanet and the Technical University of Berlin. The resulting meteor trajectories, radiant, heliocentric orbits and their errors have been tested against the results of up-to-date published meteor surveys. Furthermore, the method for computing the brightness of the meteors was discussed and a routine was developed which uses the information of the camera's orientation to automatically identify the brightest stars in an image and retrieve their magnitudes in different bandwidths from a star catalogue.

As far as the development of a prototype Lunar impact flash observatory is concerned, different techniques have been discussed which could be applied in order to increase the quality of the images depicting the dark side of the Moon. The study is to be completed by

the end of this year so the techniques developed will be available for implementation during future Lunar observations.

The Virtual Meteor Observatory (VMO) has been developed in response to requirements defined by a EuroPlanet workshop in 2006. It is part of the EuroPlanet Integrated and Distributed Information System (IDIS). It is currently maintained by the Meteor Research Group of ESA's Research and Scientific Support Department in cooperation with the International Meteor Organisation.

To ensure exchange of the acquired knowledge, and further promote small solar system bodies research, a series of highly successful Europlanet workshops were organized:

- Meteor Orbit Determination Workshop (Roden, 2006) [9]
- Impact Flashes and ionospheric effects (Cologne, September 27, 2008)
- Meteoroid effects on the Hermean Exosphere: Observations, Models and Predictions for Future Missions (November 12-13, 2009, Austrian Academy of Sciences, Space research Institute, Graz, Austria)
- Meteor Observations (Armagh, 2010)
- Flashes, Craters and Moonquakes: Exploring the Present-Day Meteor Impact Flux on the Lunar Surface (October 21-22, 2010, Berlin, Germany)
- The Meteoroid Flux in the Martian Satellite System - Models, Predictions, Observational Data, and Implications (Moscow, Moscow State University of Geodesy and Cartography (MIIGAiK), July 5-6, 2012), [2]

These workshops brought together the seemingly disparate fields of meteor astronomy, hypervelocity impact physics, dust exosphere modelling, cratering, planetary interior modelling and space instrumentation under the umbrella of the impact process. Participants became familiar with the different effects of impacts, the methods of measuring them, the data reduction techniques and the models used to understand them. The workshops have helped explore the potential for future interaction between these fields with the goal that the knowledge from one discipline enhances, or even becomes the enabling factor to advance another. Finally, a future plan is to put together a schedule of actions and events with high interdisciplinary benefits to build on the legacy of these interactions.

A number of meteor publications have resulted from the Workshops and Europlanet Expert Exchange Program: journal articles [1,3,4], presentations and posters at scientific conferences, including EPSC in 2009-2012 [5-8].

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