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The Society for Interplanetary Matter (SMPH): Observational Networks, Cometary Photometry, and Outreach Activities in Central Europe

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The **Society for Interplanetary Matter (SMPH)** is a specialized scientific association operating within the *Czech Astronomical Society*, focused on the observation, analysis, and dissemination of knowledge related to interplanetary matter. SMPH integrates amateur and professional researchers from the Czech Republic, Slovakia, and neighbouring countries and supports long□term observational projects, software development, international data exchange, and educational and outreach activities related to meteoroids, comets, and small Solar System bodies.

A major component of SMPH activities is the systematic study of meteoroids entering the Earth's atmosphere. This research is conducted primarily through coordinated multi□station observing networks CEMeNT and CSMON supported by SMPH and partner organisations.

The **Central European Meteor Network (CEMeNT)** is a long□running network designed for high□precision video and spectroscopic observations of meteors and bolides. It consists of 15 fixed stations across the Czech Republic and Slovakia and has recently been expanded to the Southern Hemisphere through the installation of stations in Chile. This extension enables improved coverage of southern□sky meteor activity and contributes to reducing hemispheric biases in meteor data.

CEMeNT stations are equipped with sensitive Full HD CMOS cameras, fast lenses, and dedicated spectral setups. An angular scale up to about 2.8 arcmin/px allows accurate determination of atmospheric trajectories, heliocentric orbits, meteor shower radiants, and meteoroid physical properties. Spectroscopic measurements with dispersion of 0.48−0.50 nm/px provide information on the chemical composition of meteoroids and support classification of cometary and asteroidal meteoroid populations. Uniform instrumentation and centralized data processing based on UFO Tools software ensure long□term homogeneity of the dataset. CEMeNt data are publicly available as aggregated processed results on the CEMeNt website, meteor data are available through the open *EDMOND database*.

Complementary to CEMeNT is the **Czech and Slovak Meteor Observation Network (CSMON)**, a dense network of low□cost, fully automated observing stations operated in cooperation with the *Global Meteor Network (GMN)*. CSMON emphasizes wide spatial coverage with angular scale about 2.75 arcmin/pxand high detection rates, producing large volumes of multi□station meteor trajectories suitable for statistical analyses of sporadic sources and meteor showers. The network relies on standardized hardware and software, and automated processing pipeline using *RMS / RPi Meteor Station* software, enabling scalable expansion and easy adoption by new contributors. CSMON data are available through the *GMN Data Explorer* under a CC BY 4.0 license.

Another key focus of SMPH is cometary observation and photometry, including systematic multispectral CCD/CMOS photometry of cometary comae. Members of SMPH regularly perform visual brightness estimates as well as electronic photometric measurements using unfiltered and standard photometric bands. These observations are routinely submitted to international databases such as the International *Comet Quarterly (ICQ)* and the *Comet Observation Database (COBS)* and contribute to long□term light□curve datasets.

To support unified methodology and facilitate data processing, SMPH has developed the **Comet Observation and Photometry Program (KOPR)**, a software tool optimized for comet observers. KOPR supports both visual and CCD/CMOS observations, including multispectral photometry, and covers the full observational workflow from planning and ephemeris generation to photometric measurements and standardized reporting to international databases like COBS, ICQ, or CARA. It is already a proven tool in the community, with more than 11,800 observations submitted to the COBS database so far.

With support from the *Europlanet Society*, we are now developing new updates. These include faster image processing (calibration and stacking), better error prevention, and new tools for comet tail photometry to analyze dust grain size. These updates will make the software more powerful for both amateur and professional use. In the following years, we aim to organize a series of online and in-person workshops on the use of KOPR software in the context of contemporary problems in cometary research.

Education and knowledge transfer are integral to SMPH's mission. The society organizes seminars, workshops, and observational expeditions focused on interplanetary matter, combining theoretical background with practical training in observational techniques and data analysis. These activities support the development of new observers and maintain continuity of expertise within the regional astronomical community. SMPH is also involved in public outreach and science communication, including public lectures, media contributions, and the preservation of historically significant meteoritic sites, such as the Morávka meteorite fall monument. Through these efforts, SMPH connects scientific research with public awareness and education. Overall, SMPH provides a stable Central European platform linking coordinated meteor networks, systematic visual and multispectral comet observations, software development, and educational activities.