

From Berlin to Venus – Laboratory spectroscopy and the Venus Emissivity Mapper

Jörn Helbert, Giulia Alemanno, Alessandro Maturilli, Darby Dyar, Aurelie van Den Neucker, Solmaz Adeli, Suzanne Smrekar

The Planetary Spectroscopy Laboratory (PSL) at DLR has supported planetary missions for 20 years. With its state-of-the-art tools and equipment, the laboratory can measure emissivity spectra of planetary analogs at temperatures up to 1000K in a vacuum environment. This capability includes acquisition of VNIR emissivity spectra ca. 750K, which is crucial in supporting the VERITAS and EnVision missions. PSL has measured emissivity of >100 rock and mineral samples at 750K with hundreds more expected before Venus data are acquired. Two hemispherical reflectance units modified to acquire both visible and infrared measurements under vacuum are also available.

Cross-calibration is essential for effectively interpreting spectroscopic data from upcoming Venus missions that will observe the surface. Leading the way is the Venus Emissivity Mapper (VEM) on the NASA VERITAS and ESA EnVision missions. VEM uses a 14-band filter array to discriminate among global rock types and detect active volcanic activity by mapping thermal emission and near-surface water vapor abundance. VEM is a pushbroom multispectral imaging system with three lens elements and a single-element objective. The filter array is imaged by a two-element relay optic onto the FPA using an uncooled InGaAs detector. In addition to six surface channels, eight bands are dedicated to cloud structure, water vapor and background removal. DLR's experience with VIRTIS on Venus Express and its dedicated Venus surface emissivity measurements laboratory make it a leader in the investigation of emission spectroscopy of Venus. When combined with machine learning classification and regression techniques, these spectra will inform surface geology on Venus in new and pioneering ways.

PSL at DLR plays a critical role in advancing our understanding of planetary science and is an essential resource for the international community. Its advanced tools, equipment, and spectral libraries position it as a leader in the field of planetary research.