

Venus facilities at the DLR Planetary Spectroscopy Laboratory (PSL) in support of the ESA EnVision, NASA VERITAS, and NASA DAVINCI missions

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Abstract

Recently selected Venus missions, including NASA's VERITAS and ESA's EnVision, are equipped with Venus Emissivity Mapper (VEM) instruments [1, 2] focused on the 1 μm region. The VEM is a multi-spectral imaging system designed for global mapping of the surface in all available spectral windows. VenSpec-M is part of the VenSpec suite on EnVision, along with a high-resolution IR spectrometer and a UV spectrometer. The DAVINCI mission has a descent imager that will also obtain images of the surface around 1 μm .

The Planetary Spectroscopy Laboratory (PSL) at DLR [3] has been operating in support of planetary missions for almost two decades. PSL currently operates three Bruker VERTEX 80V FTIR spectrometers, a Bruker Hyperion 2000 microscope for micro-spectroscopy, and a Terra In-Xitu XRD system for sample characterization. Other sample preparation and analysis tools and experimental sub-systems are also available.

To support orbital surface characterisation of Venus, it is key to obtain emissivity spectra for Venus analog materials in the region from 800nm to at least 1.2 μm at Venus surface temperatures. PSL can measure emissivity spectra of planetary analogues at temperatures up to 1000K in a vacuum environment [4-6]. Hemispherical reflectance measurements at high temperatures have been shown to be convertible to emissivity for most materials. PSL has two hemispherical reflectance units available that can be mounted in the internal chamber of the Bruker VERTEX 80V spectrometer.

The calibration and verification efforts for the VEM and VenSpec-M channel on EnVision include measuring the emissivity of over 100 rock samples at Venus surface temperatures and recording hemispherical reflectance [7,8]. These data will be used for the basic and enhanced calibration datasets for the VERITAS and EnVision missions. However, a good cross-calibration between the missions is essential, and team members from VERITAS, EnVision, and DAVINCI have started discussing cross-calibration efforts.

[1] J. Helbert *et al.*, 2019, doi: 10.1117/12.2529248. [2] J. Helbert *et al.*, 2022, 10.1117/12.2634263. [3] A. Maturilli, J. Helbert, M. D'Amore, I. Varatharajan, and Y. Rosas Ortiz, 2018 10.1117/12.2319940. [4] J. Helbert, et al., 2021, doi: 10.1126/sciadv.aba9428. [5] M. D. Dyar *et al.*, 2020, 10.1016/j.icarus.2020.114139 [6] M. D. Dyar, et al., 2020, doi: 10.1029/2020gl090497 [7] Alemanno et al., 2023, this meeting [8] Maturilli et al., 2023, this meeting