Emission Spectra of Analogues for the MERTIS Instrument on the BepiColombo Mission to Mercury

A. Morlok[1], M. P. Reitze[1], I. Weber[1], C. J. Renggli[2], S. Klemme[3], J.H. Pasckert[1], T. Heyer[1], N. Schmedemann[1], J.Benkhoff[1], H. Hiesinger[1], S. Adeli[4]

[1]Institut für Planetologie, Wilhelm-Klemm-Strasse 10, 48149 Münster, Germany (morlokan@uni-muenster.de), [2]Max Planck Institut for Solar System Research, Justus-von-Liebig-Weg 3, 37077 Göttingen, Germany, [3]Institut für Mineralogie, Corrensstrasse 24, 48149 Münster, Germany, [4]DLR, Rutherfordstrasse 2, 12489 Berlin, Germany

Band Ratios:

- The MERTIS (MErcury Radiometer and Thermal Infrared Spectrometer) is a mid-infrared imaging instrument, onboard the BepiColombo ESA/JAXA mission to Mercury expected to arrive in 2026.
- MERTIS covers the wavelength range from 7 to 14 µm, which will map the mineralogy of the surface of Mercury [1,2].
- The main challenge with the spectra is to obtain quantitative mineralogical information from the vast amount of data.
- For quantitative mineralogical data, laboratory emission spectra will be needed for detailed modelling.
- The IRIS laboratory at the Institut für Planetologie (Universität Münster) geared up its effort, in line with ongoing work at the DLR in Berlin [e.g., 3] to enhance its database with emission data to complement the already large reflectance spectral library [4].

Techniques:

- We expanded our Vertex70v infrared spectrometer in the IRIS laboratory with a Harrick Emission Accessory, which acts as the infrared light source [5, 6] (Fig. 1).
- The sample and background material (<< 1 gram) are enclosed in a separate stage (6 mm in diameter and 4 mm in height) (Fig. 1).
- The stage is evacuated down to high vacuum (10-6 mbar), heated to temperatures up to 450°C
- The temperature is controlled by two thermocouples, for a better determination of the temperature in the sample itself due to possible temperature gradients inside the sample chamber.
- For each analytical run, first a series of background followed by a sample spectra is obtained at the usual sequence of temperatures: 100°C, 200°C, 300°C, and 350°C.
- The background material consists of a fine ground industrial slag, a featureless amorphous material. The sample spectra are ratioed against these background blackbody slag spectra [7].
- All spectral data will be made available in the IRIS database [4] in the future.

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Results & Discussíon (Fig.2):

- Christiansen Feature (CF) shifts to lower wavelengths with increasing temperature:
    - 0.10 µm (53 Enstatite) to 0.61 µm (66 NP HMg GLASS)
    - Reststrahlenbands (RBs) usually have smaller shifts (<0.1 µm), except for 66 NP HMg GLASS (0.47 µm – 0.7 µm).
    - The broad Transparency Feature (TF; often a shoulder) also shifts to lower wavelengths.
    - This can lead to overlap of TFs with RBs (e.g. 2 Labradorite; Fig.2).
- These shifts are comparable to those observed in similar studies [8].
- 603 Ruby and 618 SiC have CF at high Wavenlengths (around 10 µm) (Fig. 2)
- Relative small amounts of these materials may affect the CF in mixtures significantly

Fig. 2

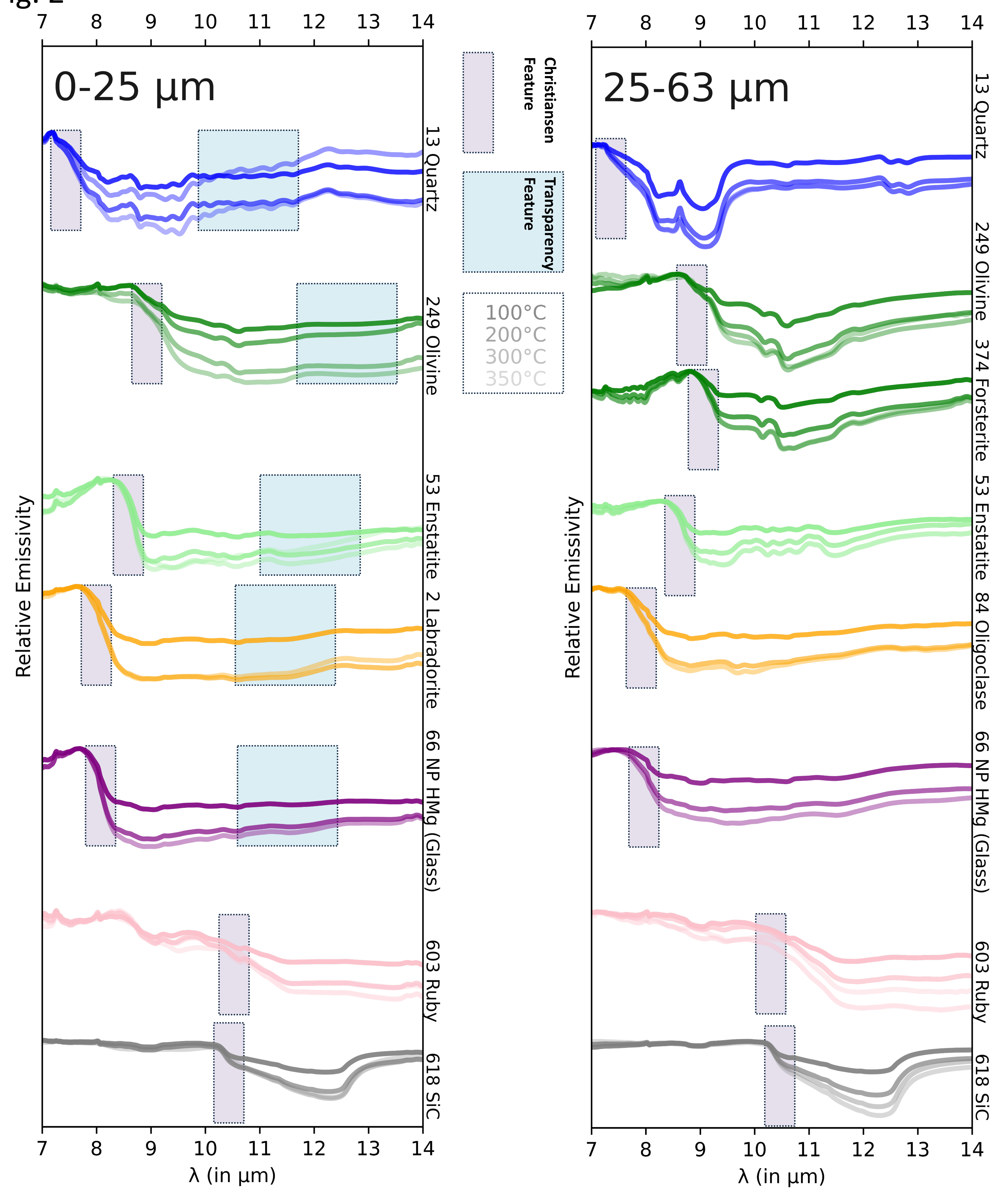
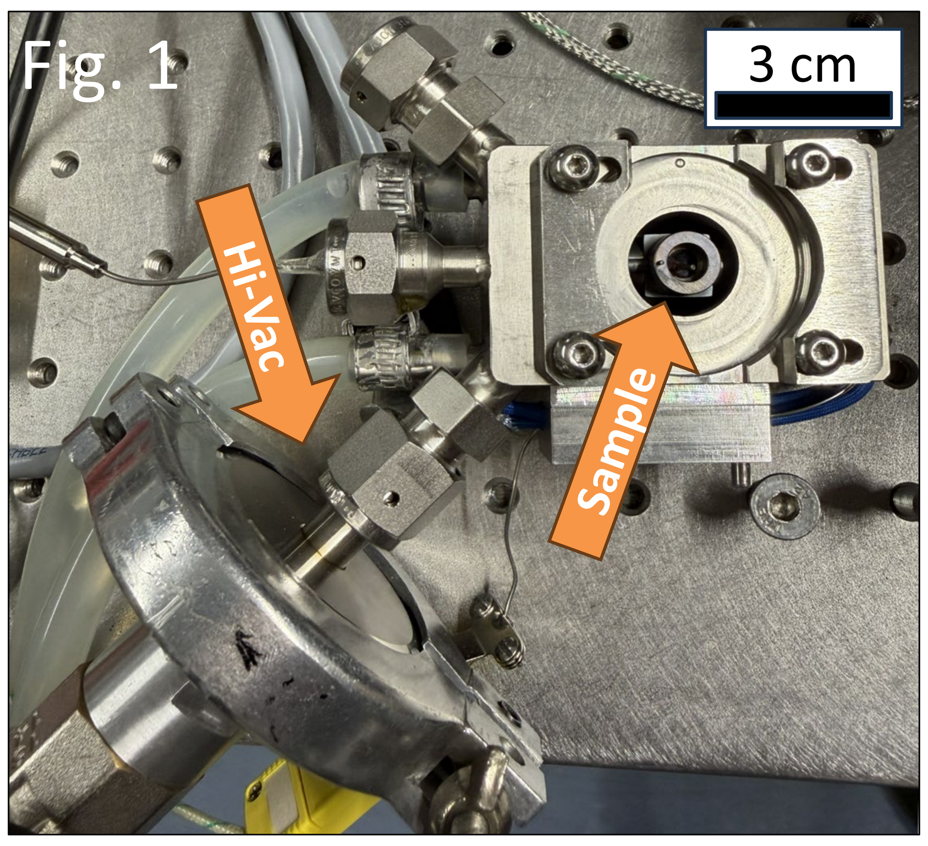


Fig. 1



Summary & Conclusion:

- We expanded our infrared database with first emission spectra [4].
- We will continue covering e.g. mixtures and various analogues.

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