

# New Insights into Lunar Volatiles

Local hydration studies and new lunar thermal emission modeling from VIS-NIR M<sup>3</sup> spectroscopy data (*Spoke 9.3.2*)

F. Colaiuta<sup>1,2</sup>, F. Tosi<sup>2</sup>

<sup>1</sup>Dipartimento di Fisica, Sapienza Università di Roma, Rome, Italy.

<sup>2</sup>Istituto Nazionale di Astrofisica – Istituto di Astrofisica e Planetologia Spaziali (INAF-IAPS), Rome, Italy.



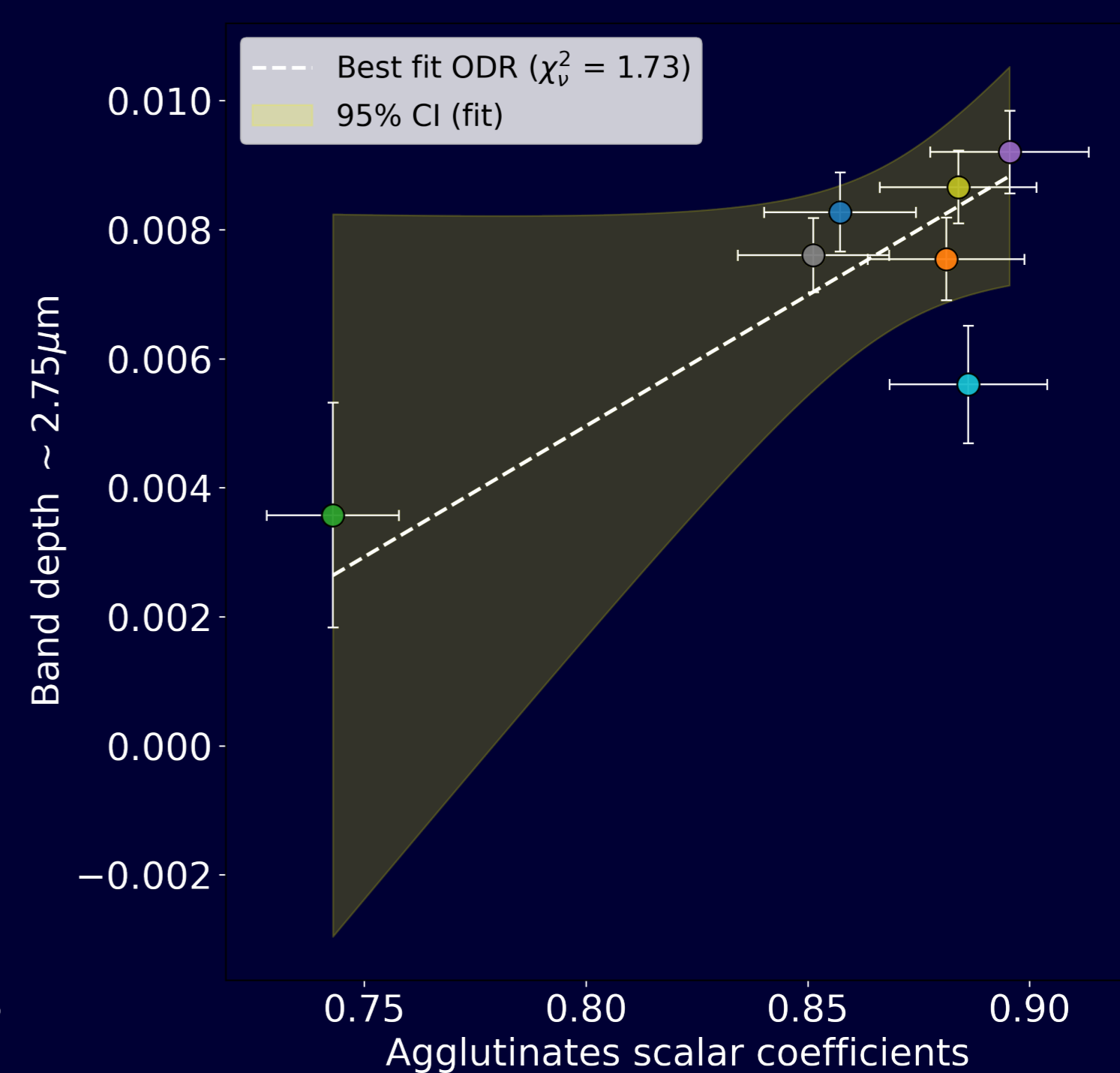
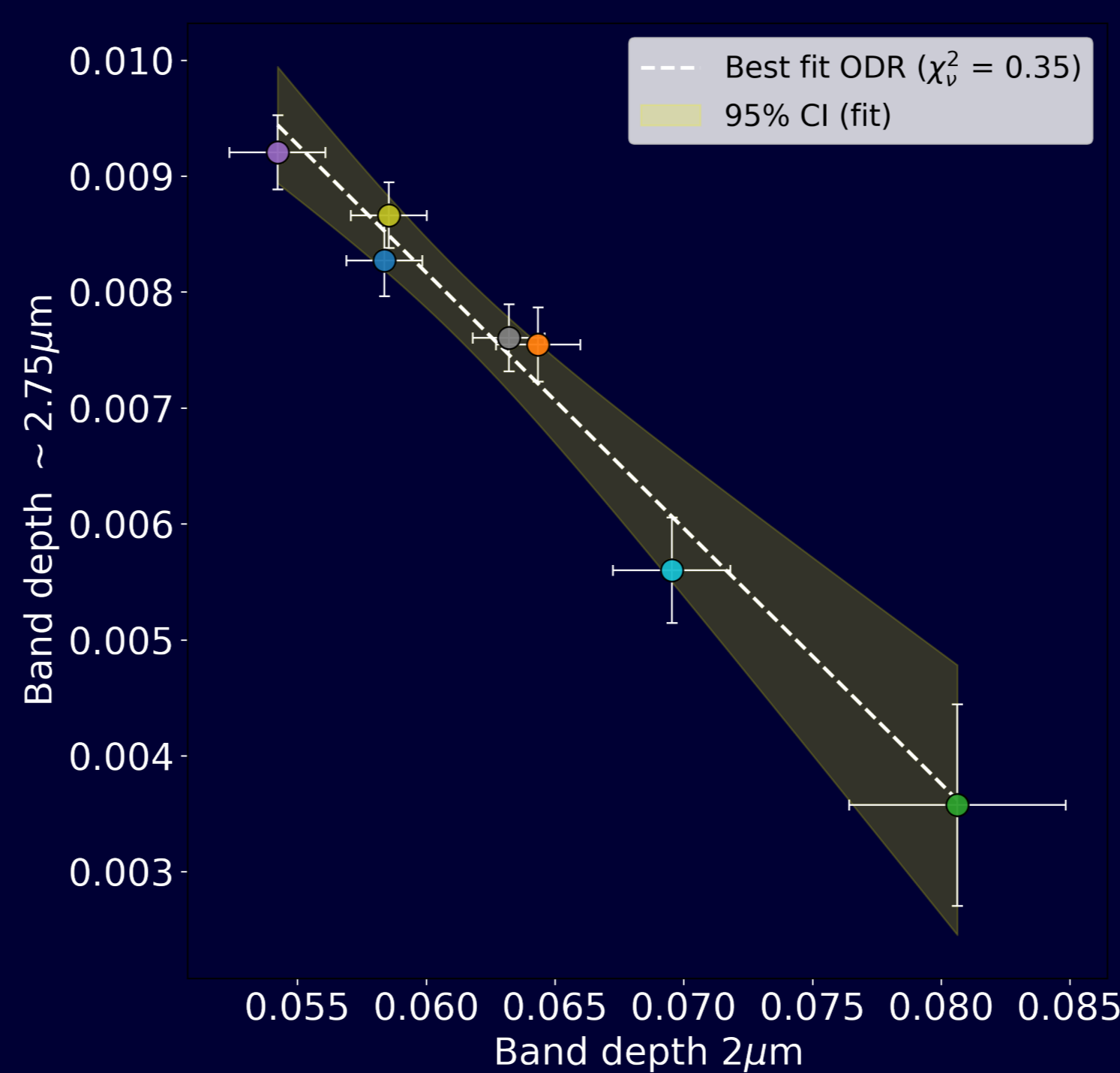
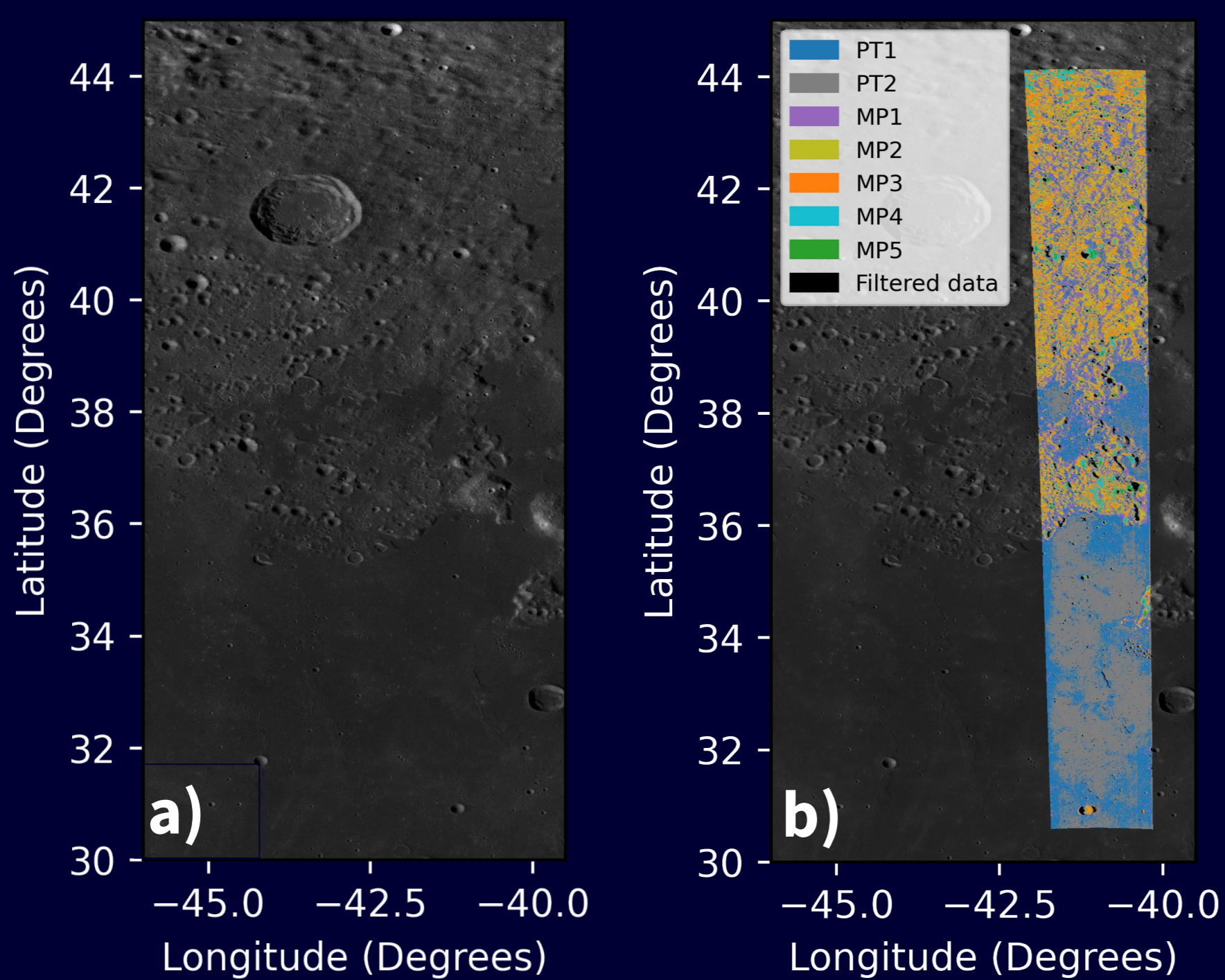
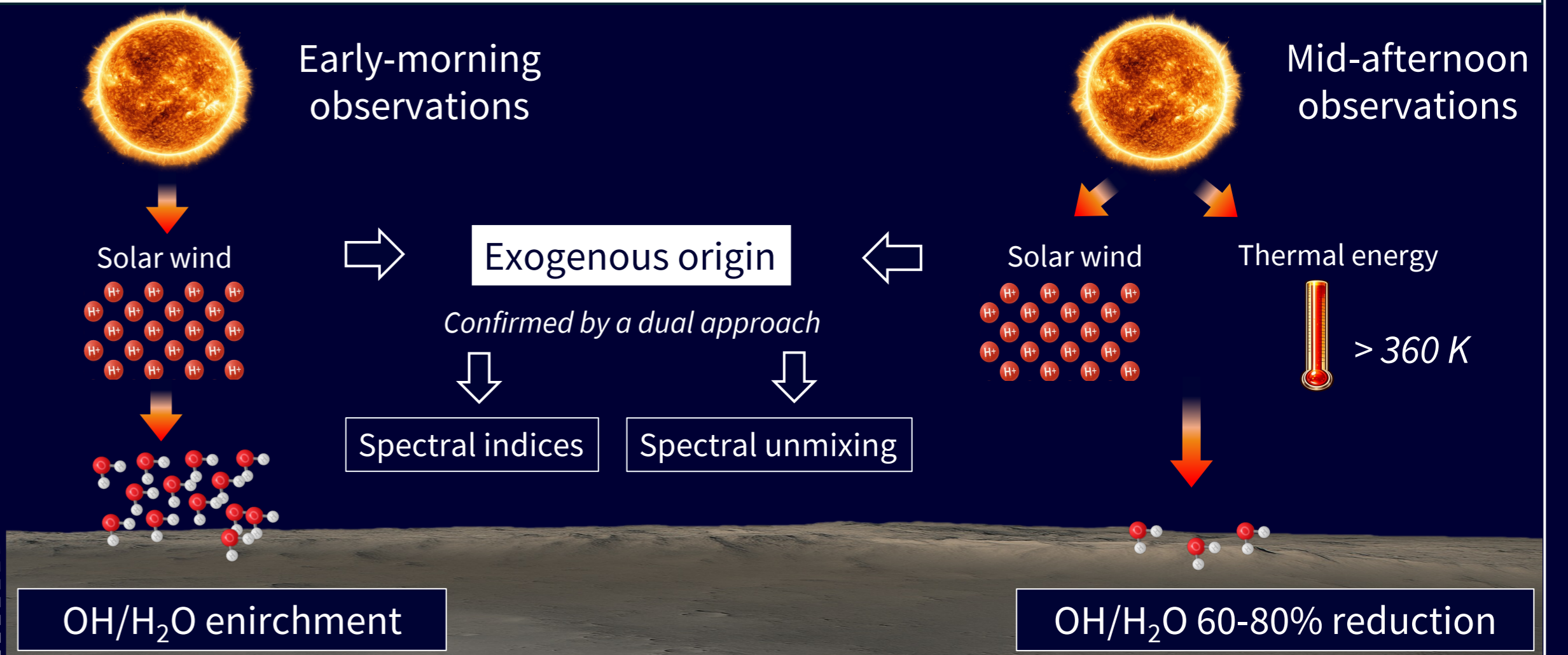
## Mairan crater as a Region of Interest to analyze OH/H<sub>2</sub>O

### What are the goals?

- To estimate at local-scale the presence of hydroxyl/water (thermal corrections → [4-6]).
- To study via target-mode clusters (**Fig. 1b**) the -OH band via spectral indices/unmixing.

### The role in Spoke 9.3.2

- To identify a new potential ROI for future robotic missions.
- To improve the understanding of exogenous water behavior, critical for future ISRU missions.



**Figure 1.** LROC/WAC image of the Mairan crater and its surroundings (**a**) and Clusters from target-mode data after PCA-based K-means clustering (**b**).

**Figure 2.** 2.75- $\mu\text{m}$  hydroxyl band depth along with the pyroxene+agglutinates 2.00- $\mu\text{m}$  band depth using [5] as thermal correction.

**Figure 3.** 2.75- $\mu\text{m}$  band depth (using [5] as thermal correction) along with the agglutinate endmember scalar coefficients.

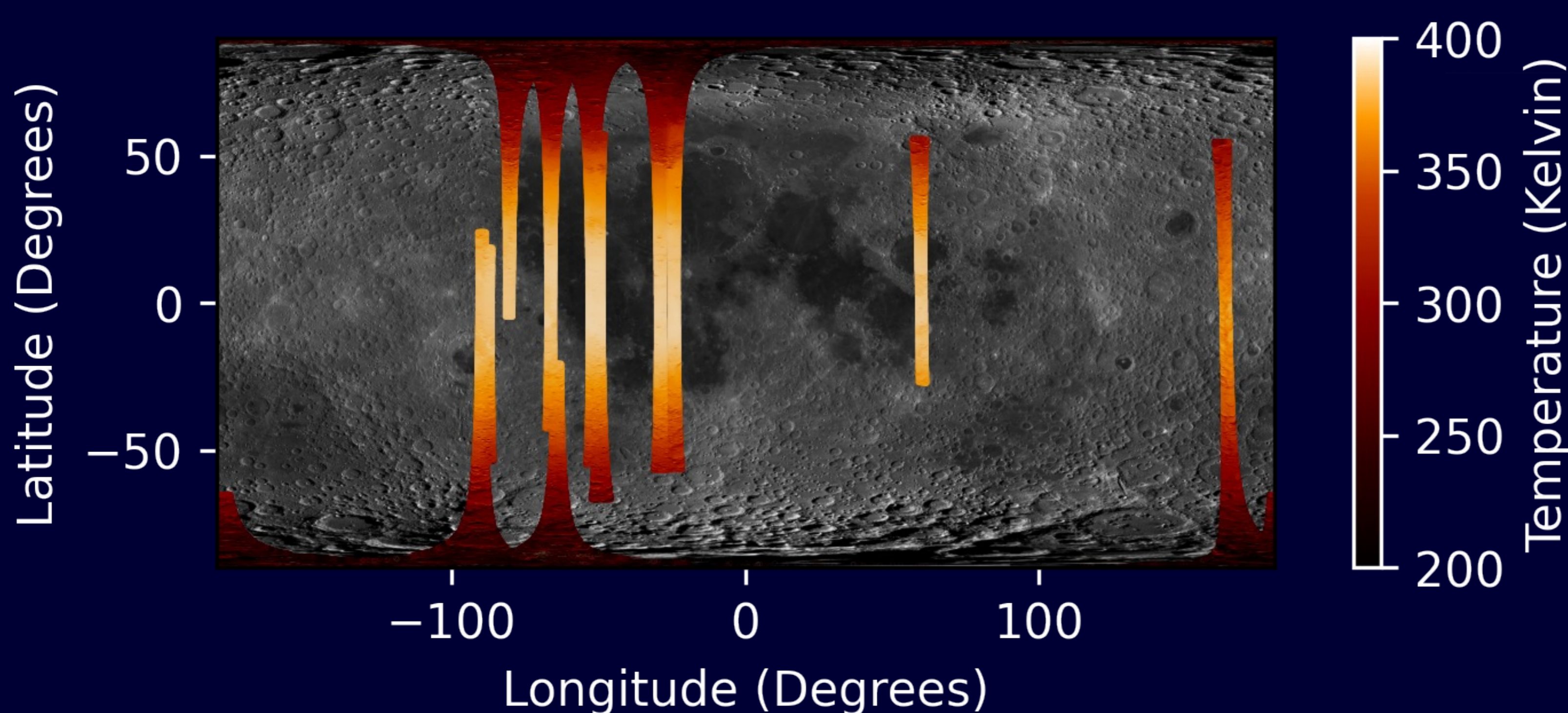
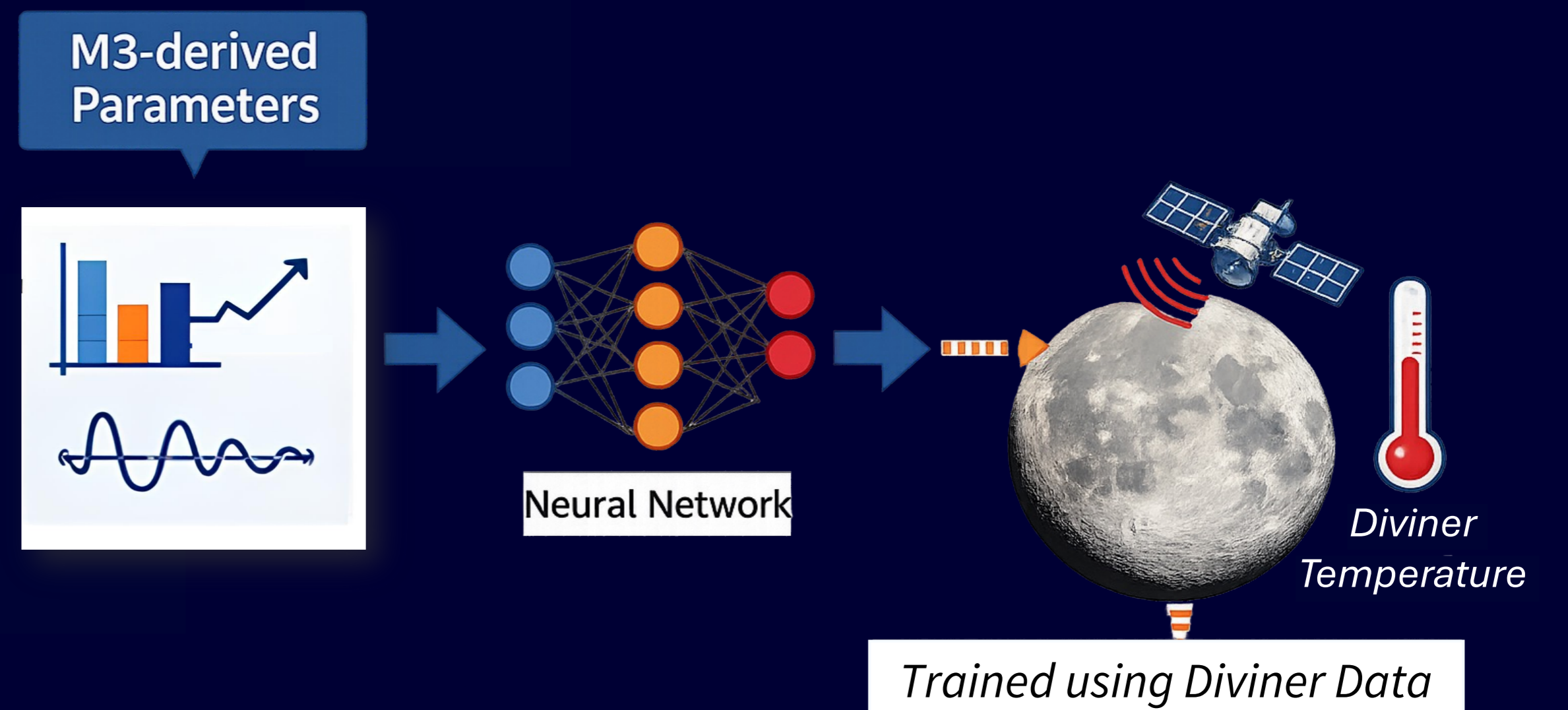
## A new tool for thermal emission modeling for M<sup>3</sup> VIS-NIR data

### Goals and model

- The goal is to model lunar thermal emission for M<sup>3</sup> data. The model is based on feed-forward fully connected neural networks architecture.
- The model is intrinsically based on M<sup>3</sup>-derived input parameters (**Fig. 4**).

### The role in Spoke 9.3.2

- This model aims to refine the lunar water content, to potentially add new insights into lunar hydration.
- It would provide a solid basis for defining future ROIs and water-related ISRU mission targets.



## References



## Contacts

federico.colaiuta@uniroma1.it  
federico.colaiuta@inaf.it  
federico.tosi@inaf.it

**Figure 4.** Modeled temperatures using our new tool for lunar thermal emission/temperature retrievals.