



## **A non-LTE retrieval scheme for sounding the upper atmosphere of Mars in the infrared**

Miguel Angel Lopez-Valverde, Maya García-Comas, Bernd Funke, Sergio Jimenez-Monferrer, and Manuel Lopez-Puertas

Instituto de Astrofísica de Andalucía / CSIC, Departamento Sistema Solar, Granada, Spain (valverde@iaa.es)

Several instruments on board Mars Express have been sounding the upper atmosphere of Mars systematically in a limb geometry in the IR part of the spectrum. Two of them in particular, OMEGA and PFS, performed emission measurements during daytime and detected the strongest IR bands of species like CO<sub>2</sub> and CO (Piccialli et al, JGRE, submitted). Similarly on Venus, the instrument VIRTIS carried out observations of CO<sub>2</sub> and CO bands at 2.7, 4.3 and 4.7  $\mu\text{m}$  at high altitudes (Gilli et al, JGRE, 2009). All these daylight atmospheric emissions respond to fluorescent situations, a case of non-local thermodynamic equilibrium conditions (non-LTE), well understood nowadays using comprehensive non-LTE theoretical models and tools (Lopez-Valverde et al., Planet. Space Sci., 2011). However, extensive exploitation of these emissions has only been done in optically thin conditions to date (Gilli et al, Icarus, 2015) or in a broad range of altitudes if in nadir geometry (Peralta et al, Apj, 2015).

Within the H2020 project UPWARDS we aim at performing retrievals under non-LTE conditions including optically thick cases, like those of the CO<sub>2</sub> and CO strongest bands during daytime in the upper atmosphere of Mars. Similar effort will also be applied eventually to Venus. We will present the non-LTE scheme used for such retrievals, based on similar efforts performed recently in studies of the Earth's upper atmosphere using data from the MIPAS instrument, on board Envisat (Funke et al., Atmos. Chem. Phys., 2009; Jurado-Navarro, PhD Thesis, Univ. Granada, 2015).

Acknowledgemnt: This work is supported by the European Union's Horizon 2020 Programme under grant agreement UPWARDS-633127