The instrument NOMAD on board the ExoMars Trace Gas Orbiter: scientific expectatives beyond the nominal goals

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1. Introduction. The Trace Gas Orbiter is the segment of the ExoMars 2016 mission in charge of the systematic observation of the Martian atmosphere and surface. It was inserted into Mars Orbit successfully last Novermber [1]. Its two most innovative instruments are NOMAD and ACS, two spectrometers of medium spectral resolution which will search continuously for trace species using both limb and nadir pointing geometries (see Figure 1). Methane and water vapor, among many trace species are expected to be detected, mostly by sounding the lowest atmospheric layers. However, both instruments offer possibilities to sound up to very high, and to open new views of the mesosphere (60-120 km) and thermosphere (up to ~200 km) of Mars, thanks to their solar occultation mode [2,3]. We will explore some of the NOMAD scientific capabilities beyond its nominal design and discuss how to exploit them, in combination with ACS, with other TGO synergistic datasets as well as with other missions [4].

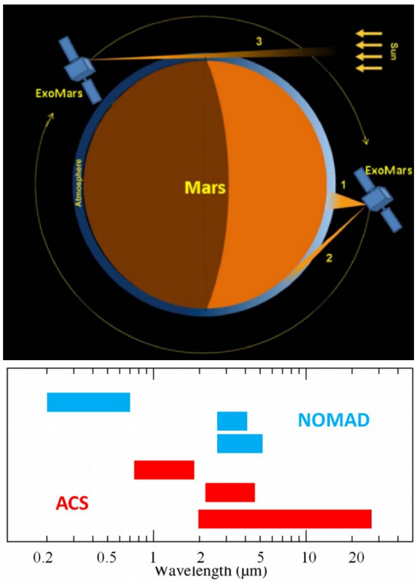

Figure 1. Top: Solar occultation & nadir views to be employed by NOMAD & ACS on board ExoMars. Bottom: spectral windows covered by the different channels of the two instruments.

2. The NOMAD instrument. Building upon the heritage of its elder brother SOIR (on board the recently ended Venus Express [5]), NOMAD uses solar occultation to derive abundance's profiles of atmospheric species with an unbeatable precision. This is the primary goal of Exomars, with target species like CH_4, H_2O, CO_2, CO, O_3, HOx, aerosols and many more expected to be detected and mapped for the first time during this Mars' mission thanks to its three channels from the UV to the near-IR (see Figure 1) [2].

3. Non-nominal observations and Synergies. The solar occultation is very precise but limited to the terminator, which is a limitation in terms of local time mapping. This is why some are promoting observations off the terminator, which could supply new data for airglow studies, in addition to an extension of the Exomars sounding in local time. This, together with the exciting in-situ drag measurements during the long aerobraking phase of the mission (Mar-2017 to Feb-2018), would represent new insights into the lower thermosphere. Combining these data with synergistic observations from instruments like IUVS/MAVEN and MCS/MRO, and also Mars Express limb observations (OMEGA and PFS) open additional possibilities to complete a mapping of the upper atmosphere of Mars as never obtained before [4].

Fuentes: [1] ESA robotic exploration of Mars website http://exploration.esa.int/mars (access date: March 2017) [2] Robert et al., **PSS**, 124, 94-104 (2016). [3] Korablev et al., **Space Sci. Rev**, submitted (2017). [4] Lopez-Valverde et al., **Space Sci. Rev**, submitted (2017). [5] Mahieux et al., **PSS**, 113 347-358 (2015).

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