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Comparative Performance of a Solar Occultation Retrieval Scheme of CO_2 for Intruments NOMAD and ACS on TGO-ExoMars

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The ExoMars Trace Gas Orbiter (TGO) will soon start its science phase, in particular taking measurements of the Martian atmosphere in solar occultation with the instruments NOMAD and ACS. This presents us with a unique opportunity to explore the atmospheric vertical structure (composition and temperature) at high vertical resolution, and hopefully in a wide range of altitudes extending into the upper thermosphere. Making good use of this data requires specialized tools, specifically a line-by-line radiative transfer model and an appropriate inversion scheme.

Our team at the Instituto de Astrofísica de Andalucía (IAA/CSIC) has performed successful retrievals of CO densities in the Venus and Earth atmospheres [1,2] and has helped develop, in partnership with IMK / Karlsruhe Institute of Technology, a line-by-line radiative transfer model (KOPRA) [3] used to simulate emission and absorption spectra primarily. In a recent and on-going effort, extensions of this retrieval scheme to Martian atmospheric conditions are being developed for emission and solar occultation spectra.

In this talk, we would like to go over the adaptations that we have made to our radiative transfer model KOPRA in order to handle solar occultation measurements, the application of the modified tool to specific selections of NOMAD orders containing strong CO_2 bands, and the incorporation of the effects of the NOMAD and ACS instruments' responses on synthetic spectra. We present the first results from our synthetic retrievals, a comparison of behavior from both instruments (NOMAD and ACS), and our plans to apply it to other atmospheric species like methane and water vapor.

Keywords: ExoMars TGO, NOMAD, ACS, inverse methods, Mars, planetary atmospheres, trace gas detection, remote sounding, CO_2, methane, water

References:

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