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A revision of the CH4 concentration in Jupiter's upper atmosphere from near-IR measurements

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Methane has a driving role in establishing the thermal structure of Jupiter's upper atmosphere. Hence, to know its spatial distribution, both in altitude and latitude, is essential for understanding that atmospheric region.
The abundance of CH4 in Jupiter's upper atmosphere has been (or will soon be) derived using a number of different methods, e.g., solar occultation, the measurements of He and Ly-alpha airglow, and from the observations of near-IR emission near 3.3 μm (ISO/SWS, JUNO/JIRAM so far and, in the near future, from JWST/NIRSpec).
The retrieved values derived from these techniques show rather different values, particularly around the homopause. Even different studies of the same ISO/SWS spectral radiance yield very different CH4 volume mixing ratio profiles.
Here, we will discuss the important role and the adequate use of the collisional relaxation of the CH4 high-energy levels when deriving CH4 abundances near the mesopause from NIR emission radiances. Further, we will also show some results on the important role of spectrocopic data of the CH4 3.3 μm hot bands for those analyses. Those studies will be presented for the particular case of the ISO/SWS measurements, although they are equally applicable to other measurement sets such as those of JUNO/JIRAM and JWST/NIRSpec.