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Infrared spectroscopy of NH_3, $PH_3$and CH_3CN for planetary applications

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This talk will be focussed on the infrared spectroscopy of several important species observed in the atmospheres of the two giant planets, Jupiter and Saturn as well as its satellite Titan. In the last decade high resolution planetary spectra have been obtained from the Short-Wavelength Spectrometer (SWS) on board of the earth orbiter ISO (Infrared Space Observatory), from the near-infrared Mapping Spectrometer NIMS on board of the Galileo orbiter and more recently from the Visible and Infrared Mapping Spectrometer VIMS and the composite Infrared Spectrometer CIRS on board of the Cassini spacecraft. Complete and accurate predictions of the line positions, intensities and line-widths of different species absorbing in the infrared range are therefore needed to retrieve their abundances. Some examples of such applications of spectroscopy in planetary science will be given. In the atmosphere of Jupiter, ammonia (NH_3) is the fourth most abundant component, after H_2, He and methane (CH_4). Its spectrum in the 3, 5 and 10 μm spectral range has brought very interesting information on the presence of an ammonia ice cloud and on the structure of the Jovian atmosphere. Phosphine (PH_3) is a minor constituent of the atmosphere of Saturn and is the main absorber in the 3 μm spectral range of this planet. Its spectroscopic study will thus contribute to the understanding of vertical mixing and of the dynamical processes in the atmosphere of Saturn. Line-lists of NH_3 and $PH_3$from 0 to about 3600 cm^{-1} have been updated and submitted to the HITRAN database. Titan's atmosphere is composed mainly of methane (CH_4) and nitrogen. Minor constituents, including nitrogen compounds like HCN and other nitriles have also been observed. Acetonitrile (CH_3CN) for example has been detected at the ppb level in the upper atmosphere of Titan using the IRAM instrument in the millimeter-wave spectral range: its observation in the infrared range by the sensitive CIRS instrument can thus be expected.

Spectroscopic work relative to the line-by-line prediction of CH_3CN in the infrared range is in progress and will be presented.