Observations of Mars at Infrared and Microwave Wavelengths: Perspectives For First

Th. Encrenaz and E. Lellouch (DESPA, Paris Observatory, 92195 Meudon, France),
M. Burgdorf(ISO Data Centre, ESA-VILSPA, PO box 50727, Madrid 28080, Spain),
H. Feuchtgruber (Max-Planck Institut, Postfach 1603, 80748 Garching, Germany),
S. Gulkis (JPL, Pasadena, CA 91109, USA) and
G. Paubert (IRAM, 7 Av. Divina Pastora, Granada 18012, Spain)

Observations of Mars have been obtained in July 1997 by the two spectrometers of the Infrared Space Observatory, in the range 2.3-180 microns. By comparing these data to radiative transfer models, the water vapor column density and the saturation altitude have been inferred (Burgdorf et al., 2000, Icarus 145, 79).Using this information, the far-infrared part of the Mars spectrum was modelled in order to retrieve information on the emissivity of the Martian surface. Signatures of carbonates might be present between 30 and 40 microns, as well as in the 7-13 micron range (Lellouch et al., 2000, Plan. Space Sci., in press). Spectral signatures, possibly due to silicates, seem to be also present at wavelengths longer than 50 microns (Burgdorf et al., 2001, ESA SP-456, in press). Observations of Mars with FIRST, using the PACS and SPIRE instruments, are expected to provide new information on the emissivity of the Martian surface at far-infrared and submillimeter wavelengths.

Molecular lines formed in the Martian atmosphere are very narrow, due to the combination of the small pressure broadening (surface pressure is only 7 mbars) and a minimal thermal broadening. Heterodyne spectroscopy provides the capability of measuring individual line shapes and is thus especially suited for the study of these spectral lines. Ground-based observations of HDO and H_2^18O have been obtained with the IRAM-30m antenna in April 1997 (Encrenaz et al., 2001, Plan. Space Sci., in press). The quality of our data, however, was not sufficient for improving the determination of D/H on Mars (currently 6 +/- 3 times the terrestrial value; Owen et al., 1988, Science 240, 1767). Observations of H2O and its isotopes with FIRST-HIFI will allow a new determination of this important parameter with a much better accuracy. In addition, FIRST-HIFI will be well adapted to the search for minor species (such as H2O2, O2, O3 or HCl) at submillimeter wavelengths (Encrenaz et al., 1995).