# OBSERVATIONS OF MARS WITH HERSCHEL: FIRST RESULTS

**P. Hartogh**, **C. Jarchow, M. de Val-Borro, A. Medvedev, M. Rengel**, *Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany (hartogh@mps.mpg.de)*, **B.M Swinyard, S. Sidher**, STFC Rutherford Appleton Laboratory, Harwell Innovation Campus, Didcot, UK, **E. Lellouch, R. Moreno**, Observatoire de Paris, LESIA, Meudon, France, **M. Blecka**, Space Research Centre, Polish Academy of Sciences, Warsaw, Poland, **G. Portyankina**, University of Bern, Switzerland, **H. Sagawa**, Environmental Sensing & Network Group, NICT, Tokyo, Japan.

**Abstract:**

Herschel has observed Mars with its three instruments, the Heterodyne Instrument for the Far Infrared (HIFI), the Photodetector Array Camera & Spectrometer (PACS) and the Spectral and Photometric Imaging Receiver (SPIRE) as part of the HssO Key programme. SPIRE provided for the first time a far infrared spectrum of Mars from 0.45 to 1.55 THz. From these observations during Ls = 5°, water vapor and carbon monoxide mixing ratios of 100 ppm and 900 ppm respectively were derived. PACS observed Mars twice during Ls = 340 ° and Ls = 108 ° in the frequency range from 1.43 to 5.26 THz. The spectra show high signal-to-noise- ratio (SNR) carbon monoxide and water lines including water isotopes. HIFI has observed Mars during Ls = 78° and Ls = 108° and performed line scans from band 1a to 6b (for technical reasons excluding band 5b). Furthermore dedicated observations on carbon- and oxygen isotopes in carbon monoxide and oxygen- and hydrogen isotopes in water vapor as well as hydrogen peroxide, hydrogen chloride and molecular oxygen were executed. The latter presents the first observation of molecular oxygen in the submm wave regime. From the very high SNR spectrum a (constant with altitude) volume mixing ratio of 1400 ppm has been derived, consistent with ground-based observations in the oxygen A band (around 763 nm) from the early 1970s. Finally from the analysis of 2 carbon monoxide isotopes a globally averaged volume mixing ratio of constant 980 ppm and a vertical temperature profile have been retrieved. Compared to general circulation model calculations the observations show up to 10 K lower temperatures in the middle atmosphere of Mars.