Direct Measurement of Ozone on Mars

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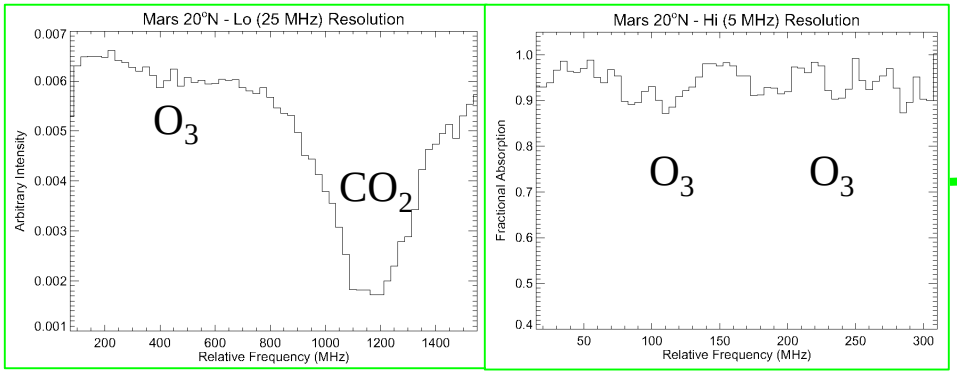
A new instrument built at the Goddard Space Flight Center, named the “Heterodyne Instrument for Planetary Wind And Composition” (HIPWAC) was used to observe the ozone distribution on Mars. The spectral resolution obtained is approximately 1,000,000. This is the highest spectral resolution currently obtained by any ground-based telescope.

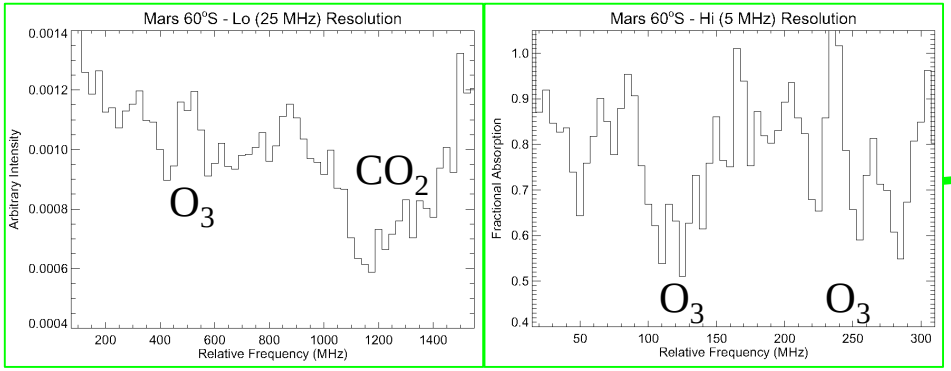
The Mars Global Surveyor has been making global maps of water vapor abundance, but it cannot observe ozone (O_3)since very high spectral resolution is required. In addition, MGS looks only at the region of Mars that is directly below the spacecraft. Over time a global map is generated. Ground-based observations can observe large areas of the planet in a single night.

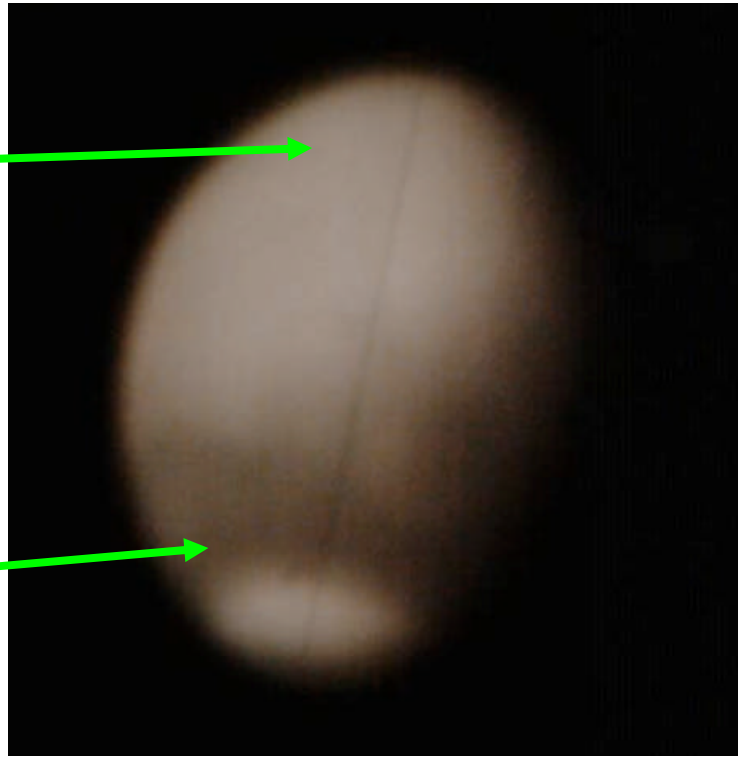
Therefore observations by MGS and HIPWAC are very complementary.

The products of water vapor photolysis destroy ozone in the upper atmosphere of Mars. At higher latitudes where the water vapor is frozen out, more ozone would be expected. This ozone/water anticorrelation has been observed before and is predicted by photochemical models. Better quantification will result in better seasonal modeling of the photochemistry of the Martian atmosphere. Because water vapor photolysis products are involved in the catalytic process that reforms CO_2, ozone is a tracer of this chemical reformation process.

Some spectra from June 2003.







Spectra of O_3 and CO_2 at a resolving power of 10^6 at 20^o N (top) and 60^o S (bottom). The O_3 is clearly stronger at 60^o S, where most of the H_2O is frozen out.

MGS water vapor measurements combined with our ozone measurements can be used to investigate the ozone/water anticorrelation and to test photochemical models.

The June 2003 observing run and the March 1999 observing run at IRTF overlap the water vapor mapping portion of the MGS mission. The results of earlier runs at IRTF (June 1988, Feb 1993, Jul 1993, March 1995) will be compared with ground-based Mars water vapor measurements taken close in time by other groups.