Worldwide Coverage: Optics, Lasers, Imaging, Fiber Optics, Electro-Optics, Photonic Component Manufacturing
PHOTONICS SPECTRA

Using photonics to solve problems of the real world

Mars Spectrometer Employs Hollow Retroreflectors

The European Space Agency's Mars Express, which was scheduled to reach Mars on Christmas Day, is expected to collect the most detailed measurements of that planet to date. Besides solving the mystery of why Mars appears to lack the ferric oxides that had been believed to be the source of its characteristic hue, it is hoped that the spacecraft's orbiter will answer questions about the potential for past or present life, using H_2O data from the Planetary Fourier Spectrometer.

The instrument is more an interferometric spectrometer than a simple interferometer, explained Sergio Fonti, its designer and a professor at the Università degli Studi di Lecce in Lecce, Italy. The double-pendulum interferometer measures 1.2- to 45-µm radiation in two channels, each equipped with a pair of hollow retroreflectors from PLX Inc. of Deer Park, N.Y. The company has a long history of making retroreflectors for space, including for missions such as the Apollo-Soyuz docking, NASA's Relay Mirror Experiment and the Japanese Space Agency's Retroreflector in Space.

The instruments are key to the spectrometer. "We use the reflecting property of the PLX retroreflectors in order to keep the spectrometer efficiency stable in spite of the strong environmental stresses," Fonti said. This is achieved using rotary movement instead of a translatory device as in a Michelson interferometer setup, in which the flat mirrors would have been nearly impossible to keep aligned.

The retroreflectors are unique in that they turn rather than remain stationary and are on a butterfly mount made of invar, which has a very low coefficient of expansion. Because the craft is subjected to unusual accelerations, the mount has to flex back and forth, yet permit no shear between the mount and the glass element.

The European Space Agency's Mars Express will investigate the red planet from orbit and from the surface. The craft's orbiter features the Planetary Fourier Spectrometer, which employs novel hollow retroreflectors.

The spectrometer divides incoming infrared radiation into two beams and directs each to the appropriate interferometer. Such an arrangement will enable researchers to discriminate the wavelengths shorter than 5 µm, which are dominated by reflection of the solar spectrum, and those longer than 5 µm, which are predominantly thermal emissions. The instrument will offer vertical and temperature profiles of atmospheric CO_2 and will detect H_2O, CO, CH_4 and CH_2O.

The Planetary Fourier Spectrometer will operate around the pericenter of Mars, collecting measurements from an altitude of 250 to 4000 km at a rate of once every 10 seconds, or 700 measurements per orbit. Mars Express will observe the planet for approximately a terrestrial year, offering an abundance of data on surface and atmospheric conditions. □

Brent D. Johnson

Contact: Zvi Bleir, PLX Inc., Deer Park, N.Y.; +1 (631) 586-4190. Sergio Fonti, Università degli Studi di Lecce, Lecce, Italy; +39 083 229 7493; e-mail: sergio.fonti@le.infn.it.

Reprinted from the January 2004 issue of PHOTONICS SPECTRA © **Laurin Publishing**