MRO/CRISM OBSERVATIONS OF PHOBOS AND DEIMOS. S. Murchie[1], T. Choo[1], D. Humm,[1] A. Rivkin[1], J.-P. Bibring[2], Y. Langevin[2], B. Gondet[2], T. Roush[3], T. Duxbury[4], and the CRISM Team, [1]Applied Physics Laboratory, Laurel, MD (scott.murchie@jhuapl.edu), [2]Institute d'Astrophysique Spatial (IAS), Orsay, France, [3]NASA/Ames Research Center, Moffet Field, CA, [4]Jet Propulsion Laboratory, Pasadena, CA.

Background: The Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) is a hyperspectral imager on the Mars Reconnaissance Orbiter (MRO) [1]. Separate images obtained by visible/near-infrared (VNIR) and infrared (IR) detectors together cover the wavelength range 362-3920 nm in 544 channels at 6.55 nm/channel with a spatial sampling of 60 µrad/pixel. Through June 2007 CRISM acquired over 1500 high spatial resolution images of Mars and mapped half the planet in a lower-resolution operating mode. In addition three images of Deimos were acquired on 7 June 2007 from a range of 22,000 km, yielding disk-resolved measurements at 1.3 km/pixel and a phase angle of 22°. Phobos measurements are planned for 22 October 2007, at a range of 7400 km and a phase angle near 29°, which will provide spatial sampling of 0.44 km/pixel.

Phobos's and Deimos's spectral properties have been difficult to determine because of their small size and proximity to Mars, which provides a significant source of interfering scattered light. Early attempts to construct composite visible-IR spectra [2] yielded C asteroid-like spectra for both bodies, leading to speculation that they are captured primitive asteroids. Later, disk-resolved measurements of Phobos from the Phobos 2 spacecraft showed that moon to be relatively red and lacking in evidence for absorptions due to bound H_2O, suggesting either a primitive but anhydrous composition (like D asteroids) or an evolved composition rich in mafic minerals but reddened by space weathering (like the lunar mare) [3]. In addition Phobos's surface is heterogeneous, with the crater Stickney exposing a material that is significantly less red than other parts of Phobos or Deimos. Subsequent telescopic measurements confirm the smooth, red spectrum of both moons and a general lack of H_2O absorptions, and that Phobos's Stickney-containing hemisphere is less red [4,5,6] than other parts of the moons.

CRISM's observations of Phobos and Deimos address the following questions:

1) What are the spectral variations on redder parts of Phobos and Deimos? Covariation of 1-micron band depth and "redness", as seen in Phobos 2 data [3], would suggest space weathering. In contrast, local exposure of hydrated material in fresh craters [7] would implicate primitive materials.

2) What distinguishes from Stickney material from the rest of Phobos and Deimos? If it is less space weathered, a strong absorption due to mafic minerals would suggest an evolved composition, whereas bound water or organics would suggest a primitive one.

3) Is there evidence for bound H_2O on either moon to support future human exploration of Mars?

First Results from Deimos and Plan for Phobos: Deimos (Figs. 1 and 3) exhibits a featureless red spectrum lacking absorptions due to H_2O or mafic minerals, corroborating earlier results. At a 4-km scale (3x3 pixels) the only observed spectral variations at the ≥1% level are continuum and thermal emission. A strong increase in emission at >2500 nm corrroborates a high surface temperatures inferred by [6].

The geometry of the planned measurement of Phobos (Fig. 2) will allow comparison of the interior of Stickney with Deimos and the rest of Phobos.

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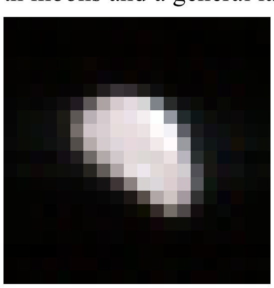

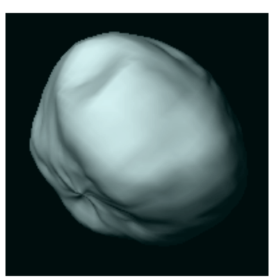

Fig. 1 (left) CRISM approximate true color image of Deimos constructed from 592-, 534-, and 484-nm images.
Fig. 2 (middle) View of Phobos for planned 22 October observations, showing the interior of Stickney at low solar incidence and phase angles.

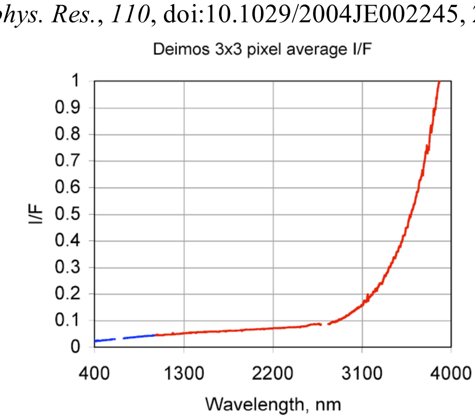

Fig. 3. CRISM spectrum of Deimos.