Description of the EPOCh Mars Observations

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EPOCh Mars Observations

The EPOCh Mars observations comprise imaging in seven optical narrow-band filters, as well as infrared (1.05 to 4.8 micron) spectroscopy. The optical images used a 512x512 subarray of the HRIV CCD detector at a scale of 0.4 arcsec per pixel, and each frame acquired by the HRII infrared spectrometer is 512 pixels (wavelength) x 128 pixels (spatial, with a scale of 2 arcsec per pixel). Because the HRI telescope used for both optical and infrared wavelengths is defocused, the spatial resolution as observed is about 4 arcsec in each case, but can be improved by deconvolution (see below).

The optical filters are centered in wavelength at approximately 350, 450, 550, 650, 750, 850 and 950 nanometers, and have FWHM bandpasses of 100 nanometers. HRIV CCD images were taken hourly in all filters, for a duration of approximately 24 hours, at one epoch (20 November, 2009, UT, see Table 1). The 450, 550, 650, and 850 nanometer filters were imaged more frequently, at a 15-minute cadence. Infrared spectroscopy was obtained every two hours, by scanning the slit of the HRII spectrometer over Mars, using a set three scans (south-to-north, north-to-south and south-to-north) consisting of 8 spectral images each to ensure the entire disk of Mars would be covered. This set was repeated twice within a twenty-minute interval every two hours, alternating between three slower scans with longer frame exposure times and three faster scans with shorter frame durations. Each set of three scans took about five minutes to acquire. The slit of the IR spectrometer was aligned to be perpendicular to the Mars's terminator during the scans; the MRI CCD was used to acquire simultaneous image of Mars as context for each IR spectral scan. The spacecraft orbit was approximately in the plane of the ecliptic; therefore the view of Mars is approximately from the equator.

Table 1. Summary of the 2009 EPOCh Mars observations.

Start Date/Time (UT)	*End Date/Time (UT)*	*Range (AU)*	*Illumination Fraction*
20 November 2009 11:53:17	21 November 2009 11:53:28	1.037	~ 90%

The units of the archived raw optical images as well as the raw IR spectroscopy are raw data counts while the units of the archived calibrated optical images and calibrated IR spectra are Watts per square meter per steradian per micron. (Both raw and calibrated data files are archived at MAST and PDS.) The calibrated HRIV CCD images have been bias-subtracted with removal of electronic crosstalk and transfer smear and nominally flat-fielded, using flat-field calibration exposures of an integrating sphere made on the ground before launch. The CCD detector response has changed in space. The most

precise photometry (e.g., for exoplanet transits) has to account for those changes, but the EPOCh team has not corrected the Mars images for changes in the CCD. The calibrated HRII spectra were linearized and dark corrected; electronic crosstalk was also removed. The CCD images were flux-calibrated using observations of standard stars, and the IR spectra were flux-calibrated using lunar observations.

The EPOCh team used the optical images to construct videos of the rotating Mars, using observations of standard stars to deconvolve the out of focus PSF of the telescope. Those videos are available on the EPOXI mission website and will be archived at PDS and MAST.