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Recent analyses of morphologies and temperatures of paterae (volcanic depressions) on Io reveal strong connections to well-supplied magma source regions in Io's interior. The uniformly dark, warm floors of many paterae are best explained as newly emplaced crusts of active lava lakes that periodically overturn as the lakes are recharged with new lavas [1,2]. One patera, Pele, is analyzed both for its similarities to and differences from other paterae. This volcano is the source of a consistently active giant plume eruption, and appears to contain a large, actively overturning, fountaining lava lake [3,4]. The 60 m/pixel, 2-filter Galileo SSI nighttime observations allow us to calculate color temperatures as high as 1620+-100K, in a few locations in the most active region in 3x3 pixel areas. Ultramafic silicates (primarily Mg-rich ol, px) have melting temperatures in this range and may be the primary component of many lava flows on Io [5,6]. Even if we assume that the source has a bulk composition on an undifferentiated Io, this would require on the order of 50% partial melting. To analyze eruption style, we calculated the fractional area of hot material across the Pele region, and determined that its highest concentration occurs in a central region about 60-80 km², while the material in the rest of the 600 km² region remains remarkably cool. Thus, fountaining and overturn at the lava lake in Pele Patera (and other paterae) may occur in small, localized regions, while the majority of the lava lake remains insulated under a cool crust. The thermal output from the high temperature components of the Pele eruption is 280 GW, and indicates a mass flux into the volcano of 6.44-8.89 x10⁵ kg/s [7]. As there is no evidence of large lava flows emerging from Pele, all of this material is confined to the patera, or is recycled back into the source region. This is true for most paterae, since they have insignificant to nonexistent shields, and thus no flank eruptions. Thus the large disparity between the tremendous mass flux into Pele and other paterae and observed erupted material is best explained if there is access to a global, subsurface, magma ocean that is continually being partially melted due to tidal heating [8]. This way, well established magma conduits are fed by an essentially inexhaustible magma supply, which can explain why most large volcanic centers on Io appear to persist over long periods of time. These paterae, with strong subsurface connections, appear to be the primary conduits for heat to escape to Io's surface, which implies that the heat flow through this energy-laden body is spatially discrete.

P12C-13 1650h

Gravity Field, Topography, and Interior Structure of Amalthea

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A close Galileo flyby of Jupiter's inner moon Amalthea (JV) occurred on 5 November 2002. The final approach was selected by the Galileo Radio Science Team on 5 July 2002. The closest approach distance for the selected approach was 221 km from the center of mass, the latitude was -45.23 Deg and the west longitude was 266.41 Deg (IAU/IAG/COSPAR cartographic coordinate system). In order to achieve an acceptable impact probability (0.15%), and yet fly close to Amalthea, the trajectory was selected from a class of trajectories running parallel to Amalthea's long axis. The Deep Space Network (DSN) had the capability to

generate continuous coherent radio Doppler data during the flyby. Such data can be inverted to obtain information on Amalthea's gravity field.

Amalthea is irregular and neither a triaxial ellipsoid nor an equilibrium body. It has a volume of about 2.4 x 10⁶ km³, and its best-fit ellipsoid has dimensions 131x73x67 km. Its mass can be determined from the 2002 flyby, and in combination with the volume, a density can be obtained accurate to about 5%, where the error is dominated by the volume uncertainty. Similarly, gravity coefficients (C_{nm} S_{nm}) can be detected up to fourth degree and order, and the second degree field (quadrupole) can be measured. Topography data are available from Voyager imaging and from images taken with Galileo's solid state imaging system at various times between February and June 1997. By combining the gravity and topography data, new information can be obtained on Amalthea's interior. For example if the gravity coefficients agree with those calculated from the topography, assuming constant density, we can conclude that Amalthea is homogeneous. On the other hand, if the gravity coefficients are smaller than predicted from topography, we can conclude that there is a concentration of mass toward Amalthea's center. We are presenting preliminary pre-publication results at the Fall meeting.

This work was sponsored by the Galileo Project and was performed at the Jet Propulsion Laboratory, California Institute of Technology, under contract with NASA. G.S., P.C.T., and W.B.M. acknowledge support by grants from NASA under the Planetary Geology and Geophysics program. G.W. is a visiting PhD student at JPL, May 2002 - May 2003, and acknowledges support from the Austrian Ministry for Technology and a Zonta - Amelia Earhart fellowship.

P21A MCC: Hall D Tuesday 0830h

Advances in Planetary Geodesy, Mapping, and Imaging I Posters (joint with G)

Presiding: J Barriot, Observatoire Midi-Pyrenees/GRGS; G A Neumann, Massachusetts Institute of Technology

P21A-0356 0830h POSTER

A New Class of Imaging Spectrometer for Planetary Science

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A NASA-funded Planetary Instrument Definition and Development Project (PIDDD) has led to the development of a new class of imaging spectrometer that combines the principal advantages of two traditional techniques used for imaging spectrometry: the signal collection advantage offered by the interferometric or Fourier Transform Spectrometer (FTS) class, and the no-moving-parts advantage offered by the dispersive and filter-array classes. This new class of imaging spectrometer, referred to as windowing interferometric, has no filters, no slit, and no moving parts. The advantage of having no moving parts provides high reliability, low cost, and allows the interferometer to be monolithic and therefore extremely rugged. The high signal collection ability of this instrument allows it to be miniaturized for use from a rover or small orbiter while still obtaining a high signal-to-noise ratio. The high signal collection ability also makes this approach ideal for missions to the outer planets.

In order to put these advantages in perspective we have developed a comprehensive classification of imaging spectrometers, and a novel graphical technique for describing the principal of operation and relative signal collection abilities of the classes of imaging spectrometers. We divide imaging spectrometers into a matrix of classes based on their method of obtaining spatial information and their method of obtaining spectral information. Methods of acquiring spatial information include whiskbroom, pushbroom, staring, and a new class we refer to as windowing. We use the term windowing to describe the new class of instruments that employ a two-dimensional FOV which moves across the object in the along-track direction during each acquisition. The

classifications by spectral approach include the familiar filtering, dispersive, and interferometric techniques. A novel graphical technique for comparing the classes of imaging spectrometers is to plot the transmittance as a function of the along-track spatial dimension and the wavelength. The temporal evolutions of these transmittance functions describe the methods of operation and provide ready insight into the relative signal collection abilities of the entire family of imaging spectrometers.

We present the design of our demonstration instrument of the windowing interferometric class, and performance results obtained in laboratory and field testing.

P21A-0357 0830h POSTER

Towards Regional Lunar Gravity Fields Using Lunar Prospector Extended Mission Data - Simulations and Results

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Until this date, the lunar gravimetric inverse problem has mainly been posed as a global problem, solving for gravity fields over the whole of the Moon. The asymmetric sampling of the force field requires that some sort of regularisation be applied in order to have a meaningful global solution that does not provide spurious information on the far side. On one hand these global solutions work very well in terms of overall orbit quality and consistency, despite the fact that roughly one half of the surface lacks sampling. On the other hand, excellently sampled regions cannot be determined at maximum spatial resolution without affecting too much the solution on the far side, which in itself is highly unstable.

Since the Lunar Prospector mission, there are many of such excellently sampled regions on the near side of the Moon. In order to exhaust the information present in the tracking data of this satellite, regional methods for solving the gravity field of well-sampled areas become interesting.

We present a method to extract regional gravity information from Doppler and Range tracking of the Lunar Prospector spacecraft. The method incorporates the GEODYN II software package for tracking data processing and orbit determination, and a software package to analyse the residuals from the orbit determination process, and to transform these residuals into gravity anomalies on the lunar surface by means of a Stokes method. Simulations will show how well a gravity signal in the residuals can be recovered. Results from orbit determination using 20 days of Lunar Prospector Extended Mission data will be shown, to demonstrate the readiness of the method to process real-life satellite data.

With missions in the future such as SELENE, which will provide the first global tracking data set of the Moon ever, global and regional methods to solve for gravity field products will remain equally of interest, since they both can give complementary insight into the low and high resolution gravity field. Regional methods can not only be used to investigate non-uniformly sampled force fields, they can also provide a localisation at higher resolution in the space domain. The method presented here can be extended to other celestial bodies of interest in planetary geodesy.

P21A-0358 0830h POSTER

Lunar Gravity Studies from the Lunar Prospector Line-of-Sight Acceleration Data: Isostatic Compensation of Medium Sized Craters

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Direct estimation of mass distribution on the lunar nearside surface using the Lunar Prospector (LP) line-of-sight (LOS) acceleration data has several merits over conventional methods to estimate Stokes' coefficients of the lunar gravity field, such as (1) high resolution gravity anomaly recovery without introducing Kaula's constraint, (2) fast inversion calculation by stepwise estimation of parameter sets enabled by small correlation between parameters sets. Resolution of the lunar free-air gravity anomaly map obtained here, is as high as a gravity model complete to degree/order 225, and yet less noisy than the recent models.

Next we performed terrain correction for the raw LOS acceleration data using lunar topography model from the Clementine laser altimetry data and the average crustal density of 2.9 g/cm^3 . By conducting the same inversion for the data after the correction, we obtained the map of Bouguer gravity anomaly that mainly reflects the MOHO topography. By comparing maps we notice that signatures of medium-sized (80-300 km in diameter) craters visible as topographic depression and negative free air anomaly, disappear in the Bouguer anomaly. The absence of mass deficits in the Bouguer anomaly suggests that the MOHO beneath them is flat. Generally speaking, longer wavelength topographic features have to be supported by MOHO topography (Airy isostatic compensation) while small scale topographic features are supported by lithospheric strength. The boundary between these two modes constrains the lithosphere thickness, and hence thermal structure near the surface. Larger craters are known to have become Mascons; mantle plugs and high-density mare basalts cause positive gravity anomalies there. The smallest Mascon has diameters a little larger than 300 km (e.g. Schiller-Zucius), and the boundary between the two compensation status seems to lie around 300 km.

Thermal evolution history of the Moon suggests temporally increasing thickness of lithosphere over its entire history, and the lithosphere as thick as 50-100 km around 4.0 Ga. This is consistent with the isostatic compensation status of the craters studied here, and a model describing the degree of lithospheric supports for various wavelength topographies.

P21A-0359 0830h POSTER

Three Dimensional Landmark Templates

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Three-dimensional surface templates are being used to identify and locate landmarks on Mars and Phobos. They can be aligned both with images and the MOLA map to help tie these two data types together. The Martian templates form a control network of well-defined and easily identified landmarks. For small bodies, templates covering larger areas can be woven together to provide a dense shape model, a single template providing thousands of body-fixed surface vectors.

Since errors exist in estimates of body-fixed landmark location, camera orientation and spacecraft location, there will be residuals between predicted and measured positions. Minimizing the mean square residuals of a single landmark over many images, and possibly the MOLA map, refines the estimate of landmark location. Minimizing the mean square residuals of many landmarks in a single image refines the estimates of camera orientation and spacecraft location.

Each surface template is represented by a pixelized array of heights, surface slopes (height gradients), and albedos, by a local coordinate system with unit vectors in the south, east and vertical (height) directions, and by a body-fixed vector from the center of the parent body to the origin of the local coordinate system.

The albedo and slope at each map pixel predicts the relative surface brightness for a given illumination and camera angle. Minimizing the mean-square residuals between this prediction and the appropriately projected imaging data over many pictures refines the estimates of slope and relative albedo. The slopes are then integrated, with a sparse set of seed heights from MOLA or surrounding templates, to provide a new set of heights. The new template is again aligned with imaging or MOLA data to begin a new estimation cycle.

P21A-0360 0830h POSTER

Imaging and Stereo Observations from HiRISE on the Mars Reconnaissance Orbiter

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The High Resolution Imaging Science Experiment (HiRISE), part of a complement of instruments that will fly on the Mars Reconnaissance Orbiter (MRO) mission, will take thousands of images of the Martian surface with unprecedented spatial resolution and quality [McEwen et al., LPSC XXXIII, 2002, 1163]. At 300 kilometers altitude, HiRISE will offer a ground sampling scale of 30.0 cm/pixel capable of detecting meter scale features. A full panchromatic image will have 20,000 pixels cross-track and 40,000 pixels down-track providing a 6 by 12 kilometer ground swath. HiRISE additionally provides a simultaneous three-color imaging capability at the same pixel scale with a ground swath of 1.2 by 12 kilometers (4,000 x 40,000 pixels) occupying the center 20% of the panchromatic imaging. HiRISE employs a Time Delay and Integration array with 128 down-track detectors that significantly increase the signal-to-noise ratio (SNR) of the imaging (>100:1 at all latitudes). HiRISE will be co-aligned with the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) and the Context Imager (CTX) instruments in order to support simultaneous observations.

The high resolution and SNR of HiRISE is expected to support landing site assessment and a wide range of geologic and climatic investigations including fluvial processes, polar geology, seasonal processes, volcanism, layering processes and stratigraphy, and glacial and regolith processes.

The off-nadir pointing capability of the MRO spacecraft will offer opportunities to acquire HiRISE stereo observations of the highest-priority locations. Digital elevation models (DEMs) will be generated using digital stereomapping techniques [Kirk et al., JGR, 104(4E)] employing automated image matching, quality control techniques, and interactive DEM editing features found in BAE Systems' commercial digital photogrammetric software SOCT SET (Softcopy Exploitation ToolSET) [Miller and Walker, ACSM/ASPRS, 1993]. Vertical precision of HiRISE DEMs is expected to be 0.1-0.2 meter.

URL: <http://hirise.lpl.arizona.edu/>

P21A-0361 0830h POSTER

Modeling Mars Rotation: the NEIGE Geodesy Experiment

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We present a complete simulation of the geodesy part of the NEIGE experiment (NETlander Ionosphere and Geodesy Experiment) that will fly on the 2009 joint US-French mission to Mars. The experiment will probe the deep interior of Mars (core and mantle) by looking at the nutations, and will monitor the balance of volatiles by looking at the length of day variations and polar motion. This objectives will be achieved by a Doppler tracking between a small network of micro-landers on Mars surface and a Mars Orbiter, and between this Mars Orbiter and the Earth. The total duration of this experiment will be at least half a martian year.

P21A-0362 0830h POSTER

Periodic anomalies in Earth-Mars range

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The distance between Earth and Mars can be inferred, with an accuracy of 2-3 m, by measuring the round trip flight time of X-band radio signals between

DSN tracking stations on Earth and the MGS spacecraft in orbit around Mars. Such measurements have been made frequently since January 1999, and mostly agree quite well with model values from the JPL export ephemeris DE 403. However, there are periodic variations in the residual range (observed minus computed) with half-amplitude 30 m and dominant period of 250 days. The cause of the difference is still unresolved.

The most likely source of small sporadic anomalies in Earth-Mars range would appear to be close encounters between Mars and any of the numerous small asteroids. However, the periodic nature of the observed anomalies seems to make that alternative unlikely.

Among other possible sources that we have considered and rejected are: (1) errors in the orbit of MGS about Mars, (2) oblateness of the Sun's mass distribution, (3) improper modeling of general relativistic effects.

Among the possible sources we have considered, and not yet rejected, are: (1) free wobble of the spin pole of Mars, (2) Previously undetected satellites of Earth or Mars.

To produce the observed period of 250 days, when projected onto the rotating Earth-Mars line, a perturbation at either end of the line must have an inertial period of 190 days.

P21A-0363 0830h POSTER

Laser Altimetry and the Cartography of Mars, Moon, and 433 Eros

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More than 72,000 laser ranges to the Moon, 16 million to the asteroid 433 Eros, and 600 million to Mars have provided the cartographic context for future exploration. In the case of Mars, the accuracy of geolocated and crossover-corrected Mars Orbiter Laser Altimeter approaches 1 m vertically and 100 m horizontally, while Eros is known at best to 10 m. Our nearest neighbor is by far the least accurately measured topographically, owing in part to the lack of altimetric crossovers.

We present advances in the registration of altimetric profiles and images on Mars and Eros. In the former case, pointing knowledge is the limiting factor, while for the NEAR-Shoemaker spacecraft, orbital knowledge was uncertain. Incorporation of altimetry in the orbit determination step improves both data kinds. Photometry, as implemented in the MOLA instrument and the Mercury Laser Altimeter to be flown on MESSENGER, provides an additional geometric constraint.

URL: <http://ltpwww.gsfc.nasa.gov/tharsis/>

P21A-0364 0830h POSTER

Deep Interior: Spacecraft Initiatives for Near-Earth Object Geophysical Exploration

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Near-Earth objects (NEOs) represent a superlative sampling of protoplanetary materials from throughout the solar system. They also have come to focus in recent years as potential natural disasters in need of careful assessment not only the determination of NEO populations and detailed orbits, but also an understanding of how they are put together, and how

they will behave during the course of energetic surface operations (from penetrometry to human visitation to diversion). We describe a concept for a robust multiple-rendezvous science mission to three representative near-Earth objects including a dormant or extinct comet nucleus. Key features include solar electric propulsion, autonomous navigation, stereogrammetric imaging, plus dual-wavelength radio tomography from orbit and small cratering science experiments for material and dynamical studies. The cratering experiments (conducted by instrumented blast payloads) will serve as precursors to future landed seismic investigations, and will enable the construction of realistic simulation environments for lowering the risk of future landed NEO missions. Mission science goals include: (1) definitive test of the rubble pile hypothesis for asteroids, (2) definitive test of the mantling hypothesis for comets, and whether primitive materials inhabit their interior, and (3) definitive study of the depth and mobility of regolith. This mission can be delivered for under the NASA Discovery cost cap. Significant payload margins allow for the addition of auxiliary landed instruments (penetrometer/seismometer) at each NEO visited, in which case the existing cratering experiments would serve as seismic signals. This combination of multiple wavelength radar tomography and seismic analysis would be an especially powerful probe of NEO interiors.

P21B MCC: Hall D Tuesday 0830h

Planetary Sheaths Posters (joint with SM)

Presiding: C Paranicas, Applied Physics Laboratory; S Livi, Applied Physics Laboratory

P21B-0365 0830h POSTER

The Medium and High Energy Neutral Atoms (MH-ENA) detector for the BepiColombo Mission to Mercury

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The charge-exchange interaction of energetic plasma of solar wind or magnetospheric origin with the exospheric gas around Mercury has the potential of generating strong energetic neutral atom (ENA) emission. The temporal evolution on short time scales of the solar wind-magnetosphere interaction as well as the magnetospheric plasma dynamics could be studied through the analysis of the flux of such energetic neutrals. The MH-ENA detector is part of the Neutral Particle Analyzer (NPA) to be proposed for the BepiColombo mission to Mercury. MH-ENA is a nadir-pointing 2-D sensor with an instantaneous FOV of 88 deg x 60deg. Its design is optimized for the detection of energetic neutrals, from 1 keV to >30 keV. The detector consists of a pinhole-focusing ENA camera. First, the environmental ions are suppressed by a biased HV collimated pin-hole telescope. The collimated energetic neutrals traverse a thin carbon foil (< 1 g/cm²), causing an up-streaming SE emission, that are collected by a dedicated MCP to generate the START signal. After a short (1 cm) flight, particles then hit a 2D detection system, which generates the STOP signal for Time-of-flight measurement, as well as the positional information for determining the velocity direction.

P21B-0366 0830h POSTER

Hermean Ion Environment

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Mercury is a planet with a relatively weak intrinsic magnetic field without an atmosphere and an ionosphere. The weak intrinsic field produces a small magnetosphere compared with the size of the terrestrial magnetosphere in which plasma can interact directly with the planetary surface. The small spatial scale, the associated short time scales for plasma processes, and the direct plasma-surface interaction produces a plasma environment that is anticipated to have unique features among the plasma environments near other planetary bodies in the Solar System.

Our knowledge of the ions near Mercury is limited due to the fact that we lack of in-situ ion measurements near the planet. The properties of the ions near Mercury are thus based on computer models, and with analogy models with the terrestrial magnetosphere. These studies suggest, for example, that the planetary ions might play an important role as a current carrier affecting thus to the global Mercury-solar wind interaction. Planetary ions can also be picked-up by the solar wind thus providing a not-thermal loss mechanism for the planetary exosphere neutrals. Some of the ions may also be precipitate the surface and affect to the emission rate of planetary neutrals and ions from the surface. Properties of the ions near Mercury gives thus a variety of information about how the solar wind particles and energy is transported through the magnetopause, the exosphere densities, acceleration of ions, the plasma-surface processes, the loss of planetary neutrals, and the role of planetary ions to the near planet.

So far the more sophisticated models to study the properties of the solar wind protons near Mercury are based on self-consistent three-dimensional MHD models. The properties of the Hermean ions have instead been studied by non-self consistent test particle simulations. We have developed a global model to analyze near Hermean ions self-consistently. The model, a queneutral hybrid model, includes several planetary ion species, such as Na⁺, K⁺, and O⁺ ions, which have been taken into account self-consistently. The planetary ions are formed from both from the exospheric neutrals by photoionization, and from the surface by ion sputtering processes. In the presentation we show how the various ion species are distributed spatially around the planet at different upstream conditions and how the ions are accelerated, by putting a special emphasis to study the question about the role of the planetary ions to the overall Mercury-solar wind interaction

P21B-0367 0830h POSTER

Electron Density Profiles Near the Midnight Venus Ionosphere

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Electron densities in the Venus nightside upper ionosphere that were derived from measurements made with the Orbiting Electron Temperature Probe (OETP) of the Pioneer Venus Orbiter (PVO) have been examined in connection with effects associated with the plasma channels that have been assumed extend downstream from the magnetic polar regions [Perez-de-Tejada, J. Geophys. Res. 106, 211, 2001]. The ionospheric density profiles obtained near the midnight plane have a signature that is different from what it is seen throughout most of the nightside hemisphere. The data in various orbits show that in the vicinity of the midnight plane there is a near constant density plateau that extends across most of the upper ionosphere from the nightside ionopause crossing (up to 2000 km) to very low (200 km) altitudes located near periapsis in the PVO trajectory. The density plateau is limited by a low altitude sharp rise with a slope that is larger than the altitude variation in the density profiles seen away from the midnight plane. It is suggested that the peculiar shape of the electron density profiles near the midnight plane is produced by the displacement of the upper ionosphere adjacent to the plasma channels that is eroded by the solar wind; and that the sharp lower edge of the density plateau results from crossing near the bottom of the plasma channels. It has also been suggested that the plasma channels provide a useful account of the ionospheric holes observed in the OETP data as regions where the ionospheric plasma density in the nightside hemisphere falls to very low values. A set of these latter features was selected to show that when they occur near the midnight plane the magnetic field measured in the solar wind is mostly oriented near the ecliptic plane. Different from this orientation it is found that in the electron density profiles with a near constant density plateau the magnetic field in the solar wind has a significant latitudinal angle with respect to the ecliptic plane. It is argued that the observation of density profiles with ionospheric holes near the midnight plane or with a density plateau in that region results from the different latitudinal orientation of the magnetic field in the solar wind. That orientation defines the position of the magnetic polar regions in the

Venus ionosphere and hence that of the plasma channels that extend behind them.

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Structure of the Magnetic Field Fluxes Connected with Crustal Magnetization at Mars and the Effect of Crustal Magnetic Fields on the Near Terminator Ionosphere: Mars Global Surveyor Observations

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The magnetic fluxes associated with the Martian crustal remnant magnetization have been studied in order to investigate the global structure of the magnetic field in and above the level of Martian ionosphere. The intensely and nonuniformly magnetized crustal sources generate an effective large-scale magnetic field. Re-connection with the interplanetary magnetic field can possibly take place in many localized regions. This will permit solar wind (SW) and more energetic particles to precipitate into and heat the neutral atmosphere. This may occur not only in cusp-like structures above nearly vertical field anomalies but also in halos extending several hundreds of kilometers from these sources. In the Northern hemisphere, the crustal fields are rather weak and usually do not prevent direct interaction between the SW and the Martian ionosphere/atmosphere. Exceptions occur in the isolated mini-magnetospheres formed by the crustal anomalies. Much stronger crustal fields are located in certain regions in the Southern hemisphere and lead to the formation of large-scale mini-magnetospheres. Numerous cusp-like regions may exist above the many crustal anomalies in the Southern hemisphere. Electron density profiles of the ionosphere of Mars derived from radio occultation data obtained by the Radio Science Mars Global Surveyor (MGS) experiment have been compared with the crustal magnetic fields measured by the MGS Magnetometer/Electron reflectometer (MAG/ER) experiment. A study of the electron density profiles obtained when the mini-magnetosphere regions are near the terminator has been conducted using the magnetic field measurements at altitudes 170-180 km and 40034 km. The altitude and magnitude of the electron density peak, the effective scale-height of the electron density and the normalized standard deviation for two altitude ranges, 145-165 km and 165-185 km, have been derived for each of the 326 selected profiles. In each hemisphere, the longitudinal variations of these derived parameters have been studied. A significant difference between the large-scale mini-magnetospheres and regions outside of them has been found. The variations of the magnitude of the electron density peak indicate that the electrons are usually "hotter" inside a large-scale mini-magnetosphere than outside. Comparison with the MGS in-situ Accelerometer data also indicates that the neutral atmosphere is persistently cooler inside the large-scale mini-magnetospheres. It appears that the strong crustal magnetic fields prevent additional heating of the neutral atmosphere by direct interaction of the SW as well as confine the hotter electrons created by photo ionization.