Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PCG033-01 Room:101 Time:May 24 08:30-08:45

Eastward elongation of Titan's dunes by transient westerlies during the passage of the intertropical convergence zone

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Numerous linear dunes with eastward streamline pattern exist on Saturn's moon Titan, particularly in the equatorial region. They have mostly been interpreted as evidence of predominantly westerly (eastward) tropical surface winds, but such winds are meteorologically hard to understand considering the angular momentum balance. This study addresses the subtle relationship between the surface wind direction and dune orientation on Titan by calculating relevant dune orientation parameters using the output of a general circulation model. In Titan's equatorial region the surface wind is dominated by the cross-equatorial meridional wind of the global Hadley circulation with superposed steady weak easterlies. The meridional wind reverses seasonally and form linear dunes along the circles of latitude. This wind system by itself cannot cause an eastward orientation of dunes. However, near the equinoxes when the Hadley circulation reverses, westerly winds temporarily appear during the brief equatorial passage of the intertropical convergence zone (ITCZ). These westerlies are turbulent and stronger than the persistent easterlies in other seasons. The eastward streamline pattern of Titan's linear dunes may have been shaped by eastward elongation of dunes by these occasional strong westerlies near equinoxes. The global migration of the ITCZ from south pole to north pole and vice versa is a result of Titan's slow rotation and Saturn's large obliquity.

Keywords: Titan, meteorology, dunes

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PCG033-02 Room:101 Time:May 24 08:45-09:00

Scattering Properties of Jovian Tropospheric Cloud Particles Inferred from Cassini/ISS

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It is essential to know scattering properties (e.g., scattering phase function) of clouds for determination of vertical cloud structure and its optical properties. However, we cannot derive the scattering phase function from ground-based and Earth-orbit observations because of the limitation of solar phase angle as viewed from the Earth. Then, most previous studies have used the scattering phase function deduced from the Pioneer 10/Imaging Photopolarimeter (IPP) data (blue: 440 nm, red: 640nm) [Tomasko et al., 1978].

There are two shortcomings in the above scattering phase function. One is that we have to use this scattering phase function at red light as a substitute for analyses of imaging photometry using CH_4 bands (center: 727 and 890 nm), although clouds should have wavelength dependency. The other is that the red pass band of IPP was so broad (595-720 nm) that this scattering phase function in red just show wavelength-averaged scattering properties of clouds.

In order to provide a new reference scattering phase function with wavelength dependency, we have analyzed the Cassini/ISS data in BL1 (center wavelength: 451 nm), CB1 (619 nm), CB2 (750 nm), and CB3 (938 nm) over wide solar phase angles (3-141 degrees) during its Jovian flyby in 2000-2001.

A simple cloud model which consists of a thin stratospheric haze, a semi-infinite cloud, and an intervening Rayleigh gas layers is adopted. Applying Mie theory to scattering by clouds, we deduce the scattering phase function of cloud and effective particle size in the South Tropical Zone. As a result, when we use the nominal value of reflective index for NH_3 ice [Martonchik et al., 1984], we cannot obtain reasonable fit to the observed limb-darkening profiles. This would imply that we should consider possible effects on the impurity and/or the nonsphericiy of clouds.

In this presentation, we will show detail model description and these results. Finally, we discuss scattering properties of clouds through comparison with previous works.

Keywords: Jupiter, atmosphere, Cassini/ISS, radiative transfer

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PCG033-03 Room:101 Time:May 24 09:00-09:15

Polarization response of the attenuation bands within Jupiter's hectometric radio emissions observed by Cassini/RPWS

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It is believed that the attenuation band within Jupiter's HOM is significant to help understand the source locations of HOM as well as the plasma environment around Jupiter. We have investigated the statistical analysis of Jovian HOM polarization plotted as a function of Jovian magnetic latitude and frequency below 3 MHz using the Cassini Radio and Plasma Wave Science (RPWS) data from Oct. 2, 2000 to Mar. 22, 2001. As a result, we found that the attenuation band plays a crucial role in not only reducing specific regions of occurrence probability and average intensity, but also amplifying the occurrence probability and average intensity of the HOM emissions next to the attenuated regions. This new additional information suggests a method of indirectly estimating the plasma environment around Jupiter by means of the ray-tracing technique. We present the polarization response of the attenuation bands within Jupiter HOM and a model which takes into account the amplified HOM radiation via ray-tracing technique.

Keywords: Jupiter's Hectometric Radio Emissions, Attenuation Bands, Cassini Spacecraft, Jupiter's Radio Occurrence Probability Map, Jupiter's Radio Average Intensity Map, Jupiter's Magnetic Field

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PCG033-04 Room:101 Time:May 24 09:15-09:30

Does an enhancement in Io's volcanic activity weaken Jupiter's magnetospheric activity?

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Io is the most volcanically active body in the solar system. Io's atmosphere consists of volcanic gas, and this volcanic gas continuously escapes from Io into Jupiter's inner magnetosphere. Jupiter's inner magnetosphere is therefore occupied by plasma which consists of heavy ions (e.g., S+, S++, S+++, O+, O++ and O+++). This magnetospheric environment is very different from that of the earth because its magnetospheric plasma has its origin almost only in solar wind. It is well-known that magnetospheric phenomena of the earth like magnetic storms are actually triggered or controlled by the solar wind or solar activity. Influence of the solar wind on Jupiter's magnetosphere is also known. However, Io's contribution on Jupiter's magnetospheric changes has not investigated well while we know Jupiter's inner magnetosphere is filled with Iogenic plasma. In this study, we tried to reveal this outstanding issue.

Jupiter's sodium nebula, extending over several hundreds of Jovian radii, is a result of atmospheric escape of sodium atoms originated from Io through Jupiter's inner magnetospheric structure named Io plasma torus. Previous studies revealed that brightness of the sodium nebula is dependent on volcanic activity on Io. We made ground-based observations of Jupiter's sodium nebula and found a distinct enhancement in 2007. In addition, activities of Jupiter's radio emissions, DAM and HOM, are also available using data from a spacecraft WIND around the time of the enhancement of the sodium nebula in 2007. These radio emission activities are believed to be related to Jupiter's aurora activities. Most of the radio signals are not contaminated by solar radio or earth's auroral radio emissions around this period fortunately. Activities of both DAM and HOM seemed to become lower after the sodium nebula enhancement in aspects of both emission power and occurrence. This relations may indicate the Io's volcanic enhancement weakened Jupiter's magnetospheric activities temporally. The Io-DAM has its source region around L=5.9, and that of HOM is L=8-11. This means Io's volcanic enhancements control Jupiter's inner magnetospheric activities in a region between L=6 and 11. However, this is an insight obtained from only a single event. More events should be studied in the suture to obtain more detailed insights.

Keywords: Jupiter, Io, magnetosphere, volcanism

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PCG033-05 Room:101 Time:May 24 09:30-09:45

Occurrence probability analyses of Jovian decametric radiation based on 3 short baselines interferometer observation

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Jovian decametric radiation (DAM) is one of Jovian auroral phenomena and its occurrence probability reflects the activity of Jovian magnetosphere. Since the discovery of DAM in 1955, it has been well known that the occurrence probability of DAM shows a long-term temporal variation with nearly 12 years periodicities, however, the origin of 12 years periodicities has not been fully understood because there are some basic considerable effects having nearly 12 years periodicities such as reception power of galaxy background radiation, shielding effect of terrestrial ionosphere, temporal variation of inclination of rotating axes of Jupiter known as De effect and the sunspot number of Sun. It is very important to evaluate these effects on 12 years periodicities of DAM quantitatively to consider the generation mechanism of DAM and the temporal variation of electromagnetic environment of Jupiter.

In Fukui University of Technology, a three short baselines interferometer has been used for occurrence probability analyses of DAM since 2001. In the observation system, the fringe waveform was stored as image data from 2001 to 2006 and has been digitalized with a sampling period of 0.2 sec and stored in HDD continuously since 2007. In the past, we have identified DAM signals by visually comparing the period of observed fringe waveform with that of theoretical one. As the result, the observed occurrence probability showed the peak value in 2001 and decreased drastically in 2003. Since 2007, the observed occurrence probability has shown gradual recovery trend.

In the present study, we apply fringe correlation analyses to the fringe waveform data from 2007 to 2010 for more objective identification of DAM signals. In the analyses, we calculate normalized cross correlation coefficients between the observed and the theoretical fringe waveforms during observation period with an integration time of 120 minutes and time interval of 1 min. The received signals are identified as DAM signals when the calculated correlation coefficient exceeds a set threshold level in all baselines. The threshold level is determined to be 2.5 sigma where sigma is a standard deviation of all correlation coefficients obtained during observation period. In order to confirm the validity of the analytical method, we plot CML vs. Io phase diagram in each year and the obtained diagrams agree with the well known pattern of the conventional diagram. In addition, the analyzed occurrence probabilities show not only a gradual increment from 2007 to 2009 which agrees with the previous result but also a sudden increment in 2010 which agrees with a trend predicted by conventional 12 years periodicity. Therefore, we conclude the fringe correlation method is useful in order to identify DAM signals objectively. As a future study, we plan to correct the effects of shielding by terrestrial ionosphere and of temporal variation of galaxy background level in order to detect the effects of solar activity, De and the impact of SL-9 comet on 12 years periodicity of DAM.

Keywords: planetary magnetosphere, Jupiter, decametric, interferometer, occurrence probability

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(May 22-27 2011 at Makuhari, Chiba, Japan)

PCG033-06 Room:101 Time:May 24 09:45-10:00

A beaming model of Jupiter's decametric radio emissions

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Jupiter is one of the most powerful radio sources at decametric wavelengths. The radio emitting frequency range is from a few MHz to 40 MHz. Jupiter's decametric radiation is considered to be the result of a highly complex interaction between Jupiter's plasma and its magnetic field. This emission is generally believed to be produced by a mechanism related to cyclotron maser plasma instability. Although there is a long history of Jupiter radio observations since its discovery in 1955, the emission mechanism of Jupiter's decametric radiation is not yet completely understood.

It has long been recognized that there is a marked long-term periodic variation in Jupiter's integrated radio occurrence probability. The period of the variation is on the order of a decade. Carr et al. [1970] showed that such variations are closely correlated with Jovicentric declination of the Earth (De). The range of the smoothed variation of De is from approximately +3.3 to -3.3 degrees. This De effect was extensively studied and confirmed by Garcia [1996]. It shows that the occurrence probability of the non-Io-A source is clearly controlled by De at 18, 20, and 22 MHz during the 1957-1994 apparitions.

We propose a new model to explain the De effect. This new model shows that the beam structure of Jupiter radio emissions, which has been thought of like a hollow-cone, has a narrow beam like a searchlight, which can be explained by assuming that the three dimensional shape of the radio source expands along the line of the magnetic field. If we consider the sizes of the radio coherent region are 1000 m along Jupiter's magnetic field line and 200 m toward the latitudinal direction, the equivalent beam pattern is 1 degree wide along Jupiter's magnetic field line and 5 degrees in latitude. As the searchlight beam is fixed with Jupiter's magnetic field, the pure geometrical effect of De can be explained by this searchlight beam model.

The Earth-Moon baseline length for the VLBI has a resolution of about 20 km for 20-25 MHz sources at Jupiter and will be able to open the window of new science for the micro structures and beaming of Jupiter's radio source. The future plan for the Jupiter radio VLBI will be presented.

Keywords: Jupiter radio, decametric wave, beam structure, radio source, radio emission mechanism, Moon-Earth baseline VLBI

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PCG033-07 Room:101 Time:May 24 10:00-10:15

Two-element radio interferometer for the observation of Jupiter's synchrotron radiation (II)

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Synchrotron radiation from Jupiter's radiation belt and its time variation show us the presence of efficient acceleration and transport of relativistic electrons in the Jovian inner magnetosphere. Recent ground based observation of Jupiter's synchrotron radiations (JSR) showed that the total flux density of them significantly enhanced at the onset of substorm-like event in the Jovian magnetosphere (Nomura et al. 2007). We proposed that two-element radio interferometer with a baseline length of a few kilometers enabled us to find the spatial characteristic of JSR during the enhanced event. In this paper, we will show results about feasibility to detect the enhanced event with two-element radio interferometer and the current status of the development of the interferometer.

We have already showed that the two element interferometer could detect the expected change in the visibility phase associated with the change in spatial distribution of JSR during the enhancement event for the case that the total flux density of JSR became 10 times greater than the usual intensity (5 Jy, Jy=10^{-26} W cm^{-2} Hz^{-1}). In this study, we also considered the weaker intensity cases (twice and 5 times) and test them. The results showed that spatial distribution changes for both cases were also detectable with the two-element interferometer.

We have started the development of a back-end receiver for the radio interferometer system. The back-end receivers consist of baseband down converter, GPS frequency standard, and high speed data sampler. The GPS frequency standard is used as a standard clock for the radio interferometer system, and K5/VSSP which is developed by the Kashima VLBI group of NICT is used as the data sampler. The allan variance of the GPS frequency standard was measured by using a hydrogen maser which was installed in the Mizusawa VLBI observatory (NAOJ). It is found that the inexpensive GPS frequency standard has a potential to detect the change in the visibility associated with the brightness distribution change during the enhanced event. The back-end receivers are planned to install in both the Iitate and Zao observatories in this spring and will be used for test radio interferometer observations at 327 MHz.

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PCG033-08 Room:101 Time:May 24 10:15-10:30

Science Operation Concept of BepiColombo/Mercury Magnetospheric Orbiter (MMO) based on 'the MDP scheme'

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BepiColombo / Mercury Magnetospheric Orbiter (MMO) , which will be launched in 2014, is mostly dedicated to the first detailed study of magnetic field and plasma environment of the planet Mercury, with wide-range observational capabilities for charged particles and energetic neutral atoms, magnetic field, electric field / plasma waves / radio waves, dust, and exospheric constituents. The scientific operation of this spacecraft is coordinated with the Mission Data Processor (MDP), which operates all payload groups aboard the MMO, MGF (Magnetic Field Investigation) for magnetic field with 2 sub instruments, MPPE (Mercury Plasma Particle Experiment) for plasma and neutral particles with 7 sub instruments, PWI (Plasma Wave Investigation) for electric field, plasma waves, and radio waves with 7 sub instruments, MSASI (Mercury Sodium Atmosphere Spectral Imager), an imaging system for the sodium exosphere, and MDM (Mercury Dust Monitor) for dust information around Mercury and the inner heliosphere.

In this paper, the summary of the science operation plan based on this 'MDP scheme' is presented. Under this concept, all payload packages will perform integrated in-situ measurements of particles and fields in and around the magnetosphere of Mercury, under the control by MDP. It enables us to obtain survey data (L-mode), normal data (M-mode), and burst data (H-mode) with coordinated manner within limited telemetry resource. Data triggering concept for H-mode is also presented. These definitions are now implemented into the flight model, and finally formalized in the MMO Science Working Group meeting in March 2011.

Keywords: Mercury, Magnetosphere, Exosphere, BepiColombo, Mercury Magnetospheric Orbiter

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Long-term variability in sodium on Mercury

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Mercury has a very thin atmosphere. The surface pressure is less than 10^{-12} atm. Since its scale height is greater than the mean-free-path near the surface, Mercury's atmosphere is called Surface-bounded exosphere. The Mariner 10 UV spectrometer detected the emission from H, He, and O atoms, which are thought to be the solar wind origin. Subsequently, the emission from Na, K, and Ca atoms were detected by the ground-based telescope. These alkali atoms are thought to be released from the surface by photon-stimulated desorption, thermal desorption, chemical sputtering, solar wind ion sputtering, and micrometeoroid vaporization.

In the detected species, sodium has been most investigated because its emission is brightest and it can be relatively easily observed by ground-based telescopes. Though many observations have been done since its discovery in 1985, the source process of exospheric sodium atoms is still unclear. In this paper, we show the past results of ground-based observations and discuss its source process.

Most remarkable feature of Mercury's sodium exosphere is the concentration at high latitudes and its temporal variability.

The planetary magnetic field of Mercury is strong enough to sustain the solar wind magnetic fields and form a magnetosphere. The cusp region, where the planetary magnetic field connects to the interplanetary field, is formed at high latitudes. Solar wind protons and other heavy ions precipitate more frequently at the cusp region than near equator. However, Kameda et al. (2007) shows that the temporal variability of average sodium density is less than ˜10%. This issue is still to be clarified.

In this study, we compare the observed sodium density with Solar EUV flux, Solar wind flux, and the distance from the ecliptic plane. Photon-stimulated desorption is caused by solar photons, whose energies are higher than UV energy. The relationship between the solar EUV flux at the wavelength from 0 to 200 nm and the Na density will be shown. We used the data obtained by SEE on TIMED. Solar wind flux also changes with time, which possibly causes temporal variability in the sputtered Na concentration. We compared the Na density with the solar wind proton flux. We used the data obtained by SWEPAM on ACE and estimated the solar wind flux. As a result, the Na density is not correlated with the solar EUV flux or the solar wind flux. Therefore these observations do not support the theory that photon-stimulated desorption or solar wind ion sputtering is the dominant source process of Na.

Assuming that interplanetary dust (IPD) is concentrated on the ecliptic plane, IPD density should be dependent on the distance from the ecliptic plane. We have developed an IPD distribution model to investigate further the relationship between atmospheric Na density and IPD distribution. We assume that the average Na density in Mercury's atmosphere is proportional to the IPD density at Mercury. The inclination (i) and ascending node (omega) of the symmetry plane of IPD are also free parameters. We searched the most relevant values for these four parameters using the least square method. The correlation coefficient can be more than 0.6 for $-104 < omega < 57$ and $i > 1.9$. Our results do not correspond completely with the past results, mainly because of the difference in the position of the observed IPD. In this presentation, we discuss the source process of sodium exosphere including the effect of solar tides.

Keywords: Mercury, Sodium, Planetary Atmosphere, Ground-based observation, Exosphere

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PCG033-10 Room:101 Time:May 24 11:00-11:15

Plan for the observation of escaping planetary atmospheres by Sprint-A/EXCEED

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Sprint-A/EXCEED is an earth-orbiting satellite to be launched in 2013 as the first mission of the small scientific satellite series of JAXA. One of the primary objectives of Sprint-A/EXCEED is to study atmospheric escape from Venus and Mars and its impact on the evolution of the planetary environments. In this presentation, the scientific objectives of Sprint-A/EXCEED concerning the atmospheric escape from Venus and Mars as well as from the Mercury's magnetosphere will be presented.

Keywords: Atmospheric escape, Venus, Mars, Mercury

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PCG033-11 Room:101 Time:May 24 11:15-11:30

Estimation of the solar wind magnetic field from the ion distribution functions observed by Mars Express ASPERA-3

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The solar wind can directly interact with the Martian upper atmosphere, since Mars does not possess a global intrinsic magnetic field [e.g., *Acuna et al.*, 1998]. Atmospheric escape induced by the solar wind has been observed by Phobos-2 at the solar maximum, and recently by Mars Express (MEX) at the solar minimum [e.g., *Lundin et al.*, 1989; *Barabash et al.*, 2007]. Escape rates of planetary ions estimated by both spacecraft indicate large dependence on the solar wind conditions [e.g., *Barabash et al.*, 2007; *Lundin et al.*, 2008].

It has been known that escaping planetary ions, which are picked up by interplanetary magnetic field (IMF) in the solar wind, are distributed highly asymmetrically in terms of the convective electric field [*Barabash et al.*, 2007]. The convective electric field in the solar wind cannot be derived directly from MEX measurements, since MEX does not carry any magnetic field detector. However, the IMF direction can be sometimes estimated from the ring-like velocity distribution of picked-up protons observed by the ion mass analyzer (IMA), which is a part of plasma packages of ASPERA-3 onboard MEX. It is because the trajectory of picked-up ions is theoretically expected to gyrate in the plane perpendicular to the IMF direction [*Yamauchi et al.*, 2006, 2008].

Here we newly developed a new semi-automated method to estimate the IMF orientation from ring-ion distributions observed by IMA, focusing on the picked-up planetary protons. As described below, we only use ring-ion signatures whose initial energy is zero, so as to exclude the components of reflected solar wind protons at the bow shock. We assume that the magnetic field direction is nearly uniform over a distance greater than one ion gyroradius and for 192 sec., the duration of the observation cycle of three-dimensional ion distribution measured by IMA. We can then presume that picked-up planetary ions form a ring distribution with a radius of the solar wind velocity in the plane perpendicular to the local magnetic field in the solar wind rest frame. The concrete procedures of estimation are as follows:

(1) We manually select the ring distribution signature near the Martian bow shock.

(2) Automatic determination of the bulk velocity vector of the solar wind in full three-dimensional scanning of IMA.

(3) Assuming that initial velocity of picked-up protons is negligible, data bins where the ring ion component is expected to be detected are selected from IMA three-dimensional velocity distribution data.

(4) Using the selected data bins where relevant ring ion components are detected in three-dimensional velocity phase space in the solar wind rest frame, we calculate the normal unit vector to the plane of a partial ring ion distribution using the Newton-Raphson method and Lagrange multipliers. The derived normal unit vector should be parallel or anti-parallel to the IMF orientation. It should be noted that we cannot derive strength and polarity of the IMF in this method.

The heavy ion precipitations up to a few keV onto Martian atmosphere are recently discovered predominantly during CIR passages [*Hara et al.*, 2011]. On the basis of a statistical study using the derived IMF data, we will also report on the effects of the solar wind electric field direction on the heavy-ion precipitations.

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Keywords: Mars, Mars Express/ASPERA-3, ring ion, IMF

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PCG033-12 Room:101 Time:May 24 11:30-11:45

The distribution of the ion number density over the crustal magnetic field on Mars

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Mars atmosphere interacts with solar wind directly without the dipole magnetic field. The observation by Mars Global Surveyor (MGS) revealed that the Martian crustal magnetic field is as strong as over 100nT at 400km altitude. In this study, the crustal magnetic field effect on the ion number density distribution is investigated by the statistical analysis.

The ion number density distribution obtained by the ion mass analyzer onboard Mars Express is shown. The available data term is from March 2004 to March 2006. The observed ion number density increase is shown in the magnetosheath as the motional electric field is southward and the dayside crustal magnetic field is strong. To examine this raise of the ion number density, the relation of the oxygen beam events and the crustal magnetic field location is investigated. In the result, we study the effects of the crustal magnetic field on the atmospheric erosion.

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

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Effects of upstream IMF direction to the ion escape from Venus

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The lack of intrinsic magnetic field on Venus results in a direct interaction between its upper atmosphere and the solar wind. This fact causes an ion outflow from Venus to the space. In the past, it has been revealed that the escape processes are controlled by the variable solar wind conditions. It is thought that the escape processes plays an important role for the evolution of Venusian atmosphere.

At present, Venus Express explored plasma environments on Venus. A lot of O+ ions with a speed over escape velocity were observed through the plasma sheet which is identified by a sharp reversal of Bx component (Barabash et al., 2007a). Therefore, the plasma sheet is regarded as the energetic ion outflow channel.

Recently, it is reported that the magnetic field environment on Venus highly depends on the direction of the interplanetary magnetic field (IMF). Usually IMF has a component to the Venus-Sun line (Zhang et al., 2009). In addition, it is also suggested by the global simulation that the IMF direction controls an atmospheric escape flux by the global change of the Venusian plasma environment (Liu et al., 2009)

In this study, we have examined dependence of high energy O+ (>100 eV) observations around Venus on the upstream IMF direction by using velocity distribution functions of plasma and the magnetic field data measured by the ASPERA-4 (Analyzer of Space Plasma and Energetic Atoms) and the magnetometer (MAG) on board Venus Express for a period from June 2006 to December 2008. The orbits are classified into two cases depending on the IMF directions: IMF nearly perpendicular to the Venus-Sun line (the perpendicular case) and IMF nearly parallel to it (the parallel case).

In most orbits for the perpendicular case, x-component of the magnetic field reverses one time per orbit around magnetic poles where the field lines most strongly drapes. The high energy O+ fluxes are also detected near the poles and some of them are observed simultaneously with the Bx reversal mainly in the nightside. In addition, the energy of O+ fluxes increases in proportion to an altitude in the dayside +E hemisphere to which the convection electric field points. On the other hand, in most orbits for the parallel case, the Bx component reverses multiple times per orbit and their spatial distribution is scattered around the terminator and wake region. The high energy O+ fluxes are also detected whole around the post terminator region, and some of them are detected simultaneously with the Bx reversal. In addition, the energy of the fluxes does not show the clear dependence on the altitude compared to the perpendicular case.

Results show that the upstream IMF direction controls the ion acceleration region. For the perpendicular case, the large convection electric field is generated in the dayside region, and the IMF drapes strongly from the terminator and forms a single plasma sheet in the nighside region. O+ ions are picked up into the solar wind due to a large convection electric field in the dayside, and ionospheric O+ ions are scavenged away by a magnetic tension force and/or a kinetic force of the solar wind from the magnetic poles to the wake region. On the other hand for the parallel case, the convection electric field becomes smaller, and the IMF drapes complicatedly, resulting in creating multiple Bx reversals in the nighside region. The multiple Bx reversals indicate that many plasma channels are formed. It is suggested that the ion pickup rate decreases and the ionospheric ions are accelerated by local effects from the multiple plasma channels in the nightside region. These results imply that the IMF direction controls the ion pickup rate and bulk outflow rate.

Keywords: Venus, plasma, Venus Express, VEX

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Development of a New Telescope Dedicated to Observation of Planets at Haleakala, Hawaii : VI

Shoichi Okano[1*], Yasumasa Kasaba[1], Masato Kagitani[1]

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We plan to construct a 1.8m new telescope at the summit of Mt. Haleakala, Maui, Hawaii in collaboration with the Institute for Astronomy of University of Hawaii, Institute of Astronomy of National Autonomous University of Mexico, and Kiepenheuer Institute for Solar Physics in Germany.

The telescope is dedicated to observation of solar system planets and exoplanets. When we try to observe a faint emission close to these targets, intense solar scattered light from the planetary disk becomes a serious problem if we see a solar system planet, and strong light from the central star in case when we are going to observe an exoplanet. In order to suppress this problem, it is necessary to avoid diffraction due to a spider structure that holds a secondary mirror and to minimize the scattered light from mirror surfaces as far as possible. To attain these necessities, the telescope optics will be an off-axis Gregorian type, and ultra-smooth mirror surface will become possible with a new polish technology called HyDra. Since a telescope with such a wide dynamic range dedicated to observation of planets does not exist yet, it is expected the telescope will become a unique facility for the ground-based observation of planets when it is realized.

A telescope project called PLANETS is being developed under a joint research agreement between Tohoku University and University of Hawaii. A basic design of the telescope has been completed and the primary mirror blank made of glass ceramic is now being manufactured.

Outline of this telescope project can be seen at http://www.ifa.hawaii.edu/haleakalanew//planets/planets.shtml, and at the presentation, current status of the development plan of our telescope will be given.

Keywords: optical telescope, planetary observation, optical infrared, Gregorian, Hawai Haleakala, off-axis

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PCG033-15 Room:101 Time:May 24 12:15-12:30

Millimeter-wave band observations of planetary atmospheres with SPART 10m telescope

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In order to investigate how activities of the Sun, which is a typical G-type star in our galaxy, influence the balance of atmospheric environments of solar planets, we are promoting a project to carry out millimeter-wave band monitoring (short/middle/long-term) observations of the middle atmospheres of solar planets by exclusively improving a ground-based 10m telescope of the Nobeyama Radio Observatory. We call this telescope "Solar Planetary Atmosphere Research Telescope (SPART)". The telescope is employing 100 and 200 GHz band superconductor/insulator/superconductor (SIS) mixer detectors with a high sensitivity achieving the quantum noise limit. Our heterodyne sensing technique at this frequency band provides us an highly-spectral resolution, which enables us to derive the vertical distribution of minor constituents and their isotopes in the middle/upper atmospheres of terrestrial and gas-giant planets in our solar system. At present we are newly developing intermediate frequency band systems, local oscillator systems, and a digital Fourier transform spectrometer (1 GHz bandwidth, 8 bit, 163484 channel) with a built-in high-speed processing FPGA, system and tracking control software. We will complete the improvements of the telescope systems within this year, and then start monitoring and line-survey observations before the next solar maximum. In this conference, we will report the progress of the project and these developments.

Keywords: miilimeter/submillimeter-wave, heterodyne remote sensing, planetary atmosphere

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Solar System Observations in Early Science Cycle 0 with ALMA

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[1]ALMA-J Project

The Atacama Large Millimeter/submillimeter Array (ALMA) will be comprised of a giant array of 12-m antennas, with baselines up to 16 km and state-of-the-art receivers that cover all the atmospheric windows up to 1 THz. An additional, compact array of 7-m and 12-m antennas will greatly enhance ALMA's ability to image extended sources. The ALMA project is an international collaboration between Europe, East Asia and North America in cooperation with the Republic of Chile.

The Joint ALMA Observatory (JAO) expects to start Early Science observations (Cycle 0) on a best effort basis late in 2011 and a call for proposals will be issued at the end of the first quarter of 2011. The ALMA Early Science Cycle 0 capabilities will comprise sixteen 12-m antennas, receiver bands 3, 6, 7 & 9 (wavelengths of about 3, 1.3, 0.8 and 0.45 mm), baselines up to 250m, single field imaging, and a restricted set of spectral modes chosen to meet a reasonable range of scientific goals. Additional capabilities including somewhat longer baselines, limited mosaic imaging, and some polarization capabilities, may be announced in the Call for Proposals.

Even at the Cycle 0 phase, the sensitivity of ALMA in spectral observations is typically 10 - 30 times higher than that of the existing millimeter and submillimeter arrays. High spatial resolution, 0".35-2".5 dependent on observing frequency, and high spectral resolution will enable observers to image detailed features of planets and to reveal kinematics of planetary atmosphere. For example, 1 sigma senstivity in brightness is less than 1 K with a velocity resolution of 0.1 km s-1 and an angular resolution of 1" at 345 GHz. The ALMA data can be compared directly with theoretical studies enriching our understanding of the planetary science.

Successful proposers for Early Science Cycle 0 will share risk with ALMA. ALMA staff will conduct quality assurance on ALMA data, and will provide reduced data products through the respective ALMA Regional Centers (ARCs). However, it cannot be guaranteed that projects will be completed or that the characterization and quality of the data and data reduction will meet the standards expected when ALMA is in full scientific operations.

If your affiliation is in Japan, the East-Asia ALMA Regional Center located in the NAOJ campus in Tokyo will provide user support in many aspects. We present the ALMA Cycle 0 capabilities and its expected outcome for potential observers.

The key dates in the current plans for Cycle 0 are given below. It is still possible that changes in circumstances may make it necessary to alter them.
-2011/03/31: CfP for ALMA Early Science Cycle 0 and release of offline Observing Tool.
-2011/06/01: Opening of archive for proposal submission.
-2011/06/30: Proposal Deadline.
-2011/09/30: Start of ALMA Cycle 0 observing.

Keywords: ALMA, Radio Interferometer, Early Science