Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

PEM27-01 Room:301A Time:May 24 09:00-09:15

Relaxation of pressure anisotropy and the evolution of Magneto Rotational Instability in collisionless accretion disk

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Magneto-Rotational Instability (MRI) is a plasma instability which is considered to take place in a magnetized differentially rotating astrophysical disks. It was first proposed by Velikhov in 1959 and later by Chandrasekhar in 1960. Its importance in astrophysical rotating disk was pointed out by Balbus and Hawley in 1991. This instability can generate MHD turbulence within a few periods of orbit and can generate a strong turbulent viscosity. Thus this instability is considered to play a major role in the context of accretion which requires a strong viscous effect to transport angular momentum in the disk.

These nonlinear behaviors of MRI, such as generation of turbulence or accretion due to the strong turbulent viscosity, are mainly studied by numerical simulations under MHD approximation which assumes the plasma as a single component fluid. However, recent analytical and numerical studies have shown that kinetic effects can be important on the evolution of MRI in dilute accretion disks which are often found around black holes. These studies have mainly focused on the effect of pressure anisotropy and results from the linear theory indicates that initial pressure anisotropy may severely affect the evolution of MRI. Since these studies were carried out with Landau fluid closure, relaxation process of ion pressure anisotropy was included by so-called ”Hard Wall approximation”.

In this study, we newly developed a hybrid code in a local differentially rotating system, including the process of ion’s pitch angle scattering in a self consistent manner. From the results, we find a relaxation of pressure anisotropy by effective pitch angle scattering during the evolution of MRI. In this presentation we would like to focus on the effect of initial pressure anisotropy on the evolution of MRI.

Keywords: Collisionless Plasma, Accretion disk, Magneto Rotational Instability

PEM27-02 Room:301A Time:May 24 09:15-09:30

The structure of an outflow during an X-line retreat

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Particle-in-cell simulations of magnetic reconnection are performed to study the structure of an outflow in asymmetric reconnection. Here the asymmetry is introduced by setting a hard wall that blocks one of the outflows from the reconnection region while leaving sufficient free space in front of the other outflow. Eventually this setting leads to a slow motion of the diffusion region away from the wall, the so-called 'X-line retreat'. During the retreat the structure of the electron outflow against the wall is similar to that seen in a reconnection jet just prior to termination of reconnection in a size-limited simulation box. This implies that the X-line retreat occurs to keep the minimum open space in front of the outflow that makes a reasonably good reconnection rate to be available.

Keywords: magnetic reconnection

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PEM27-03 Room:301A Time:May 24 09:30-09:45

Simulation study of magnetic reconnection in high Raynols number plasma

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Magnetic reconnection is important process for dynamics in space and laboratory plasmas. Magnetic reconnection is basically dominated by magnetic diffusion at thin current sheet as proposed by Sweet (1958) and Parker (1963). According to their theory, the reconnection rate must be inversely proportional to the square root of the magnetic Reynolds number (S). But in spite of high magnetic Reynolds number (>10ˆ12) in magnetosphere or the solar corona, fast reconnection which rate is about 10ˆ-2 is observed. Slow shock, the Hall- effect and some other processes are considered as the cause of accelerating reconnection. But the mechanism is not fully understood yet. Although in the Sweet and Parker theory, the stability of current sheet is assumed. The recent studies pointed out that current sheet can be destabilized when the magnetic Reynolds number is very large.

Lapenta (2008) investigated how the stability of current sheet and the reconnection rate depend on S using the numerical simulations. As a result, they suggested that, once the instability of current sheet grows, fast reconnection is realized and the reconnection rate becomes insensitive to the magnetic Reynolds number. However they studied the cases only for S = 10ˆ3 to and 10ˆ4 and in which relatively large disturbance of magnetic field is initially imposed to drive the instability of current sheet. Therefore, the transition from the Sweet-Parker type reconnection to the current sheet instability is not yet well understood.

In this paper, we developed the high-resolution magnetohydrodynamics (MHD) simulation of magnetic reconnection in high-S regime aiming at revealing the acceleration mechanism of magnetic reconnection . To obtain this purpose, we apply the HLLD Rieaman solver which was developed by Miyoshi and Kusano (2005) to the high resolution two-dimensional MHD simulation of current sheet dynamics. The HLLD Rieaman solver is a highly accurate and efficient scheme and recently adopted by many standard MHD packages.

In our model, the initial state is given by the Harris sheet equilibrium plus perturbation, of which the amplitude is varied as a parameter. We will talk about the dependency of magnetic reconnection rate, which is defined as the production rate of reconnected magnetic flux, both on S and the amplitude of initial perturbation. We also discuss how the size distribution of plasmoids generated by the current sheet instability is related to the acceleration of magnetic reconnection.

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PEM27-04 Room:301A Time:May 24 09:45-10:00

Validation of a newly developed divergence-free high-resolution MHD code against magnetic reconnection related problems

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Understanding the physics of unsteady turbulent magnetic reconnection phenomena in compressible flows is of significant interest in a wide range of space plasma sciences. Early computational works for such turbulent magnetic reconnection flows were dedicated to use a conventional approximate Riemann-type solver, and thus are often too dissipative to resolve the broad range of scales of MHD turbulence and the resultant reconnection phenomena. As a result, the prior simulations employed an anomalous resistivity with some tuned parameters to generate active magnetic reconnection, and they also concluded that at least Hall MHD simulation is necessary to investigate the reconnection phenomena. However, we emphasize that these conclusions were drawn based on using a conventional low-order accurate numerical method. The whole point of our thinking is that if we could construct a physically-consistent high-order accurate numerical method within the MHD approximation, the high-order accurate MHD simulation could be possible to predict the physics of unsteady magnetic reconnection phenomena. We verified this idea by developing a physically-consistent high-order accurate numerical method for compressible MHD simulation and applying it to the problem of interaction of multiple magnetic islands in a long current sheet. The results showed that similar to the two-fluid simulation and PIC simulation the MHD simulation successfully predict the unsteady nature of the active magnetic reconnection phenomena such as X-lines movement and the growth of the magnetic island. The results demonstrate the importance of employing the physically-consistent high-order accurate numerical method for studying the magnetic reconnection phenomena. Furthermore, we think that this study could be extended to investigate the physics of turbulent (thus three-dimensional) magnetic reconnection and planetary formation phenomena.

Keywords: magnetic reconnection, MHD simulation

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PEM27-05 Room:301A Time:May 24 10:00-10:15

Three-dimensional asymmetric magnetic reconnection

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A kinetic model of asymmetric magnetic reconnection in three-dimensional space is analyzed theoretically and with numerical calculations. Consider the case where the two magnetized plasmas are colliding each other; for example suppose that the plasma shock is propagating through the uniform background plasma.

In order to provide a clear understanding of the magnetic reconnection presented here, we show a simple representation of the model with the cartoon in Fig.1. *PlasmaA* is the stationary plasma whose magnetic field is given by B_1. *PlasmaB* is propagating with the velocity v_s in the positive y direction. The electric field of this plasma is given by $E_2=(v_s/c)B_2$ (c being the velocity of light). The magnitude of the field is smaller than that of the field B_1, i.e., $B_1 < B_2$. The crossing angle is defined as the angle between the fields B_1 and B_2. This angle plays an important role in generating the magnetic neutral sheet. If the crossing angle is greater than a right angle, then the magnetic neutral sheet is created in front of the shock. The resonant particle interacting with the shock is trapped by the neutral sheet. Accordingly such the particle is accelerated by the electric field E_2 in the neighborhood of the neutral sheet. If the angle is nearly equal to a right angle, the direction of the acceleration is almost the same as the direction of the magnetic field B_1. The reason is that the direction of the electric field is almost the same as the direction of the field B_1. This is the way of the field-aligned acceleration presented by the author [1]. If the crossing angle is smaller than a right angle, then the magnetic neutral sheet is not created. Therefore the effective energy gain of the particle cannot be expected.

[1] S. Takeuchi, Phys. Plasmas 19, 070703 (2012).

Keywords: asymmetric magnetic reconnection, particle acceleration, plasma shock wave

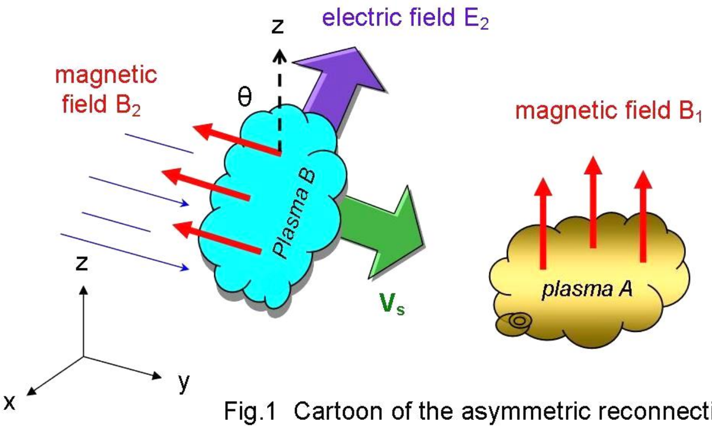

Fig.1 Cartoon of the asymmetric reconnection

PEM27-06 Room:301A Time:May 24 10:15-10:30

Collisionless magnetic reconnection under the Landau fluid approximation

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Magnetic reconnection has been widely researched as a mechanism of generation of hot and fast plasma flow by releasing magnetic enregy stored in a system. Especially, the reconnection accompanied by slow shocks around a localized diffuion region, so-called Petschek type reconnection, is regarded as important from the point of view of the rate for magnetic energy release. In collisionless plasmas, however, the knowledge of this type of fast reconnection is not enough now.

In general, it is known that ions are accelerated along magnetic field lines from a diffusion region. Due to this beam component, the distribution function of ions is largely disorted and the temperature along the magnetic filed is enhanced. Althogh PIC or hybrid simulations have been performed to solve the effect of the beams self-consistently, the results do not indicate the clear evidence for generation of slow shocks predicted by Petschek's theory.

In our research, as an intermediate picture between the ordinary isotropic MHD aproximation and the kinetic theory, we performed a series of fluid simulations by using the double adiabatic limit and the Landau closure model. We investigated the effect of the pressure anisotropy and the Landau damping on global dynamics of magnetic reconnecion.
Under the fluid apprximation, the parallel pressure is enhanced across the slow shock since mirror motions are accelerated with the deformation of magnetic flux tubes. The structure downstream is greatly difference from the isotropic MHD case, and the outflow region becomes wider. In this talk, we report the detail of the structure formation.

Keywords: magnetic reconnection, collisionless plasmas, Landau fluid

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PEM27-07 Room:301A Time:May 24 10:30-10:45

Kinetic modeling of asymmetric reconnection

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At dayside magnetopause, magnetic reconnection takes place between the terrestrial dipole field and the solar-wind magnetic field. In such an configuration with asymmetric upstream conditions, reconnection behaves differently from the standard symmetric reconnection in the magnetotail. Since the upcoming MMS mission will extensively probe dayside magnetopause during its first phase, it is of immediate importance to understand key properties of asymmetric reconnection. In the MHD regime, the CSB (Cassak-Shay-Birn) theory is very successful to approximate reconnection properties with asymmetry. However, in the kinetic regime, recent simulations have reported that the reconnection rate is substantially lower than the CSB prediction. We investigate the anomalous slow-down with particle-in-cell simulations. This is attributed to the kinetic dissipation mechanism around the electron-scale dissipation region. In this contribution we discuss the electron motion near the dissipation region, its impact on the global reconnection rate, and the influence of the guide-field geometry.

Keywords: Magnetic reconnection, Kinetic simulation, Magnetic dissipation, Magnetopause

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PEM27-08 Room:301A Time:May 24 11:00-11:15

Nonlinear dissipation of the imbalanced Alfvenic turbulence

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Nonlinear evolution of Alfvenic turbulence is a fundamental process in the solar wind magnetihydrodynamic (MHD) turbulence. The past observational studies suggested that the MHD turbulence close to the sun is the "slab" fluctuation, where the wave number vector is parallel to the ambient magnetic field, while the "2D" fluctuation, where the wave number vector is perpendicular to the ambient magnetic field, becomes dominant with increasing heliocentric distance. However, the energy transfer process from the "slab" fluctuation to the "2D" fluctuation is still unclear. In the present study, we numerically discuss the nonlinear evolution of the "imbalanced (high cross helicity)" Alfvenic turbulence by using a two-dimensional ion hybrid code. The dissipation processes related to the ion kinetics are demonstrated.

Keywords: solar wind, MHD turbulence

PEM27-09 Room:301A Time:May 24 11:15-11:30

Sigma problem of the Crab Nebula & energy dissipation by parametric instability of large amplitude electromagnetic wave

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The Crab Nebula is one of the supernova remnants known best. Today a theoretical model for the nebula is established by Kennel&Coroniti(1983). First, the central star (a pulsar) rotates and creates pair plasmas (electron-positron plasmas). Then the plasmas blow outward accompanying a certain wave as pulsar wind. The wind forms a shock wave and its downstream side is observed as the nebula. Although there must be a energy dissipation of extremely high efficiency from the field to plasmas in pulsar wind region, this mechanism is unknown (sigma problem).

By the way, in space plasmas, especially for solar wind, shock or magnetic reconnection, nonlinear wave-wave interactions are important. Parametric instability is one of these processes, where an incident nonlinear wave decays into several different wave modes satisfying the matching conditions for both frequency and wavenumber.

In this study, we analyze a parametric instability of relativistically intense circularly polarized electromagnetic waves, considering application on sigma problem. Following Max (1973), Lee&Lerche (1978), we analyzed the instability of these waves in a cold relativistic electron-ion plasma. We then extend the analysis to an electron-positron plasma including the effect of relativistically hot temperature. For simplicity, we use 2-fluid equations and get self-consistent equilibrium solutions. Furthermore, we also consider direct-current magnetic field and derive dispersion relation of the instability.

We also discuss an efficiency of energy dissipation by the instability, using a Particle-In-Cell (PIC) simulation code.

Keywords: relativistic plasma, electron-positron plasma, parametric instability, crab nebula, pulsar, particle simulation

PEM27-10 Room:301A Time:May 24 11:30-11:45

Effect of the magnetic field inhomogeneity on the generation process of whistler-mode chorus emissions

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Whistler-mode chorus emissions with rising tones are generated through the nonlinear wave-particle interactions occurring in the region close to the magnetic equator. The mirror force plays an important role in the nonlinear interactions and the spatial inhomogeneity is a key parameter of the chorus generation process. The spatial magnetic field inhomogeneity along a field line is widely changed during a geomagnetically disturbed period. In the present study, by a series of self-consistent electron hybrid code simulations, we discuss the effect of the spatial inhomogeneity of the background magnetic field on the generation process of whistler-mode chorus emissions. We have conducted numerical experiments with different spatial inhomogeneities of the background magnetic field, while we assume that the initial velocity distribution function and the number density of energetic electrons are the same at the magnetic equator in all simulation runs. The simulation results reveal that the spectral characteristics of chorus significantly varies depending on the magnetic field inhomogeneity. In the simulation result assuming the smallest inhomogeneity, we observe the excitation of broadband whistler-mode waves whose amplitude is comparable to distinct chorus elements appeared in other simulation runs. We find that the broadband waves are a group of wave elements with rising tones nonlinearly triggered in the region close to the magnetic equator. Based on the simulation results, we show that the small spatial inhomogeneity of the background magnetic field results in the small threshold amplitude for the nonlinear wave growth and makes the triggering process of rising tone elements to emerge easily in the equatorial region of the magnetosphere.

Keywords: whistler-mode chorus, numerical experiment, wave-particle interaction

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PEM27-11 Room:301A Time:May 24 11:45-12:00

Gyrokinetic approach to Alfvenic coupling of magnetosphere and ionosphere plasmas

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The magnetosphere-ionosphere (M-I) coupling through the shear Alfven waves plays a key role in spontaneous growth of quiet auroral arcs in polar regions. The feedback instability in the M-I coupling system, which explains simultaneous growth of ionospheric density, field-aligned current, and electric field perturbations, has often been analyzed by the MHD or two-fluid equations. For a more realistic analysis under the magnetospheric condition, however, kinetic effects of ions and electrons are necessary to be incorporated in the theoretical model.

The gyrokinetic (GK) equations for magnetized plasmas have been derived for describing the Alfven and drift waves of which frequency is much lower than the gyro-frequency. Using a theoretical model reduced from the GK equations, we have developed a linear formulation of the feedback instability in a flux tube geometry, where the finite Lamor radius (FLR) effect of ions can be accurately incorporated. The FLR effect leads to increase of the real frequency of the feedback coupling in a large perpendicular wavenumber region. The dispersive Alfven wave is also described by the gyrokinetic equations for electrons and the ion polarization effect. The feedback instability analysis will also be addressed in case with the kinetic electrons.

Keywords: gyrokinetics, magnetosphere-ionosphere coupling

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PEM27-12 Room:301A Time:May 24 12:00-12:15

Killing Flows and Thermodynamics in Minkowski Space

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Thermodynamical approach is often fruitful in investigating large scale plasma phenomena. Assuming local equilibrium, one can handle physical processes such as heat flow using thermodynamics. In relativity, however, our non-relativistic common sense on thermodynamics is not always directly applicable. For example, it has been well known that the local temperature of a relativistic rotating wheel is lower at the axis than at the rim. In such a situation, heat can spontaneously flow from low temperature regions to high temperature regions.

Therefore, one must know how the relativistic thermal equilibrium can take place globally to investigate thermal processes. The author has discussed relativistic equilibrium with parallel motion and rotation in the past meetings; the present talk is to treat the four dimensional relativistic equilibrium from a more general view point.

Thermal equilibrium can take place when the matter is moving with rigid motion, in other words, the proper distance of each element is unchanged during the motion. Geometrically this kind of motion can be expressed as motion along Killing flows. There can be ten linearly independent Killing flows in a four dimensional Minkowski space, and the simple way to express them is four parallel motion and six rotational motion. Possible Killing flows are superposition of these ten, and can be more complicated. Letaw and Pfautsch (1981) have shown that various Killing flows can be categorized into six groups. The first two are the parallel and rotational motion, for which the author has reported equilibrium states in the past meetings.

The other four contains so called static limits, which means a matter cannot stay at a point with fixed spatial coordinates beyond these limits. The light cylinder and ergo region of a Karr black hole are examples of such limits. Thermodynamics across the static limit is interesting topic itself, and applicable to the thermodynamics of accretion plasmas falling into a black hole.

Keywords: relativity, thermodynamics, Killng flow, black holes

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PEM27-13 Room:301A Time:May 24 12:15-12:30

Generation of Radio Waves in the Plasma Environments of Regions close to the Event Horizon of Schiwartschild Black Hole

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1. Introduction Since 1984, the quest of radio wave pulses from the center of our Galaxy have currently been carried out in our studies. For the decameter and decimeter radio wave pulses it is concluded that these pulses are generated from the rotating black holes whose rotation periods supposed to be coinciding with the observed radio wave pulses. Furthermore it is proposed that the source positions are located in the region very close to the event horizon of the black holes being based on the lowness of the observed frequency and steadiness of the period. In the previous our works where the generation and amplifications of plasma waves near the event horizon of Schiwartschild black holes are theoretically considered being based on the general relativistic electromagnetism apparent possibility of generation of the electromagnetic waves has been verified contrary to the general criticisms that there may no generation of radio wave in the regions close to the event horizon due to depression effects of photon energy caused by the effects of general relativity. In the present works we have further completed the theory and calculated wave parameters which are observable ,as decameter to decimeter wavelength pulses, based on possible plasma condition in the region close to the event horizon of the super massive Schiwartschild black holes.
2. Theory The analyses are based on the 4-dimensional gauge potential equations where the source currents consist of wave components in plasma which are subjected to the momentum transfer from the resonated electron beams that are flowing towards event horizon being enhanced by intense gravity of BH. Improvement has been made to gauge potential equations instead of solving previously proposed 4x4 element matrix to solving the 5x5 elements matrix that are required to have non-trivial solution for the forth dimensional gauge potential equation in plasma. This is caused by consideration of more general constrain for the gauge potential. That is, a new variable should be introduced to obtain self consistent system of equations.
3. Results and Discussion Numerical analyses have been carried out mainly for angular frequency around decameter frequency, 20MHz which are kept as constant value through whole range of space of the present interest, near the event horizon whose position are expressed by the parameter R; R=1-rg/r where rg is Schiwartschild radius and r is the distance from the center of the black hole. Validity of the present new method has been checked by comparing with traditional dispersion equations of Appleton-Hartree in the non relativistic cases (R=1).The amplification of the waves are indicated for the case where the wave propagate with directional component towards the event horizon that is in parallel to the direction of the electron beam. Significant growth of the waves take place in the regime of the UHR branch that appears between local plasma frequency and upper hybrid frequency.The results give confirmation to the previous results that the wave make significant growth even in region deep inside or close to the event horizon R=1E-5 .

Investigations of plasma parameters in the region R=1E-2 to R=1E-6 indicate that local plasma frequency and electron cyclotron frequency are in the range from 1E11 to 1E14 Hz, when we consider the intrinsic values. That is we are observing these high frequency phenomena translated to the range of decameter to decimeter wave length range because of effects of general relativity.

4. Conclusion The present study on generation of the plasma waves based on the improved approach of general relativistic electromagnetic equations, considering together the beam plasma wave interaction, gives results that the region deep inside, toward event horizon, even at R=1E-6 ,for an example, there becomes the source region of the low frequency radio wave such as the case of decameter to decimeter wavelength radio waves.

Keywords: Black Hole, Shiwartzschild, General Relativistic EM Theory, Plasma Waves, Near Event Horizon

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PEM27-14 Room:301A Time:May 24 14:15-14:30

International collaborative study on spacecraft-plasma interactions in the near-Sun environment

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Space exploration and exploitation have been rapidly increasing, and a strong demand arises regarding comprehensive understanding of spacecraft-plasma interactions. Numerous numerical tools have been developed in response to such requests, such as Nascap-2k, SPIS, MUSCAT, and other original codes developed by individual researchers. However, it is difficult to understand diverse conditions of spacecraft-plasma interactions by using only one model, because each model has its own advantages and disadvantages depending on employing numerical schemes and modeling techniques. Hence, we have organized an international team for the study of spacecraft-plasma interactions from 2011 and worked on a common problem via multiple numerical tools.

As one of such collaboration activities, we study on the physics of spacecraft-plasma interactions in the near-Sun environment. The spacecraft environment immersed in the solar corona is characterized by a large photoelectron emission current caused by an intense solar flux and a secondary electron emission current due to ambient plasma impingement on the spacecraft surfaces, which lead to much different nature of spacecraft-plasma interactions from that in the near-Earth environment. Consequently, the spacecraft is reported to be charged negatively near the Sun unlike usual photo-emitting spacecraft in the near-Earth environment. In the present study, we reproduce the plasma environment around the Solar Probe Plus satellite planned by NASA by using the multiple numerical tools. We particularly focus on the properties of negative potential barriers created by a dense photoelectron cloud and the wake structure behind the spacecraft to understand the process of spacecraft-plasma interactions. We will show some preliminary simulation results mainly obtained from our original PIC simulator EMSES.

Keywords: spacecraft-plasma interactions, solar coronal plasma, spacecraft charging, photoelectron emission, spacecraft wake, PIC simulation

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PEM27-15 Room:301A Time:May 24 14:30-14:45

Structures of bow shock and boundary layer of ion scale magnetosphere

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[1]Osaka Prefecture University

Interaction between the solar wind and the mini-magnetosphere of dipolar magnetized objects is investigated by a three-dimensional hybrid simulation, which treats the ions as kinetic super particles via particle-in-cell method and the electrons as a massless fluid. The hybrid simulation is suitable for the study of the mini-magnetosphere which scale is an order of the ion Larmor radius of the solar wind ions at the magnetopause boundary, because the ion kinetic effects are important for its structure. Since the dayside sheath thickness is also an order of the ion Larmor radius, the bow shock has a downstream transition region which overlap with the boundary layer of the magnetosphere. We will also discuss the effects of the interplanetary magnetic field (IMF) condition for the bow shock and boundary layer structures of the ion scale magnetosphere.

Keywords: ion scale magnetosphere, 3D hybrid simulations, bow shock

PEM27-16 Room:301A Time:May 24 14:45-15:00

A finite volume formulation of the multi-moment advection scheme for Vlasov simulations

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The Vlasov simulation is known as one of plasma kinetic simulation methods, in which the Vlasov equation is discretized on grid points in phase space. Compared to the Particle-In-Cell (PIC) method, the Vlasov simulation is free from the statistical noise and is easy for parallel computation. On the other hand, the Vlasov simulation has the difficulty in advancing the distribution function in velocity space. Especially, the Vlasov simulation of magnetized plasma is quite difficult, owing to the gyro motion around the magnetic field line (solid body rotation in velocity space).

To overcome the difficulty, we have developed a multi-moment advection scheme (Minoshima et al. 2011; 2013). The scheme treats not only point values of a profile but also its zeroth to second order piecewise moments as dependent variables. The scheme remarkably reduces numerical diffusion and is suitable for advancing the distribution function in velocity space. We have successfully applied the scheme to electromagnetic Vlasov simulations.

Here, we newly propose a simplified form of the multi-moment advection scheme. The new scheme treats zeroth to second order piecewise moments as dependent variables at cell center, while point values of a profile are not. Then the scheme adopts a collocated grid system. The basic equation is discretized in a finite volume formulation. A numerical flux at cell face is evaluated by a one-dimensional high-order interpolation, even in multi-dimensional problems. These modifications greatly simplify the scheme compared to the previous one. Benchmark tests of a multi-dimensional advection and rotation problem show that the new scheme keeps profile well for very long time calculation (~1,000 rotations). The application of the scheme to electromagnetic Vlasov simulations will be presented.

Keywords: Vlasov simulations

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PEM27-17 Room:301A Time:May 24 15:00-15:15

High-resolution global Vlasov simulation of small body in the solar wind using K computer

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The interaction between a plasma flow and a small dielectric body with a weak intrinsic global magnetic field is studied by means of a five-dimensional full electromagnetic Vlasov simulation with two configuration and three velocity spaces. The interaction of a plasma flow with a dielectric object is quite different from that with a magnetized object such as the Earth. Due to the absence of the global magnetic field, the dielectric object absorbs plasma particles which reach the surface, generating a plasma cavity called a wake on the anti-solar side of the object. In the present study, entry processes of ions into the nightside wake tail are examined. A high-resolution simulation run is now performed by using the K computer. A preliminary result will be shown.

Keywords: computer simulation, Vlasov code, K computer, small body