The workshop from the space plasma physics perspective

Masaki Fujimoto
ISAS, JAXA
Magnetospheric processes

- Mass loading
- New current system

Exospheric processes

- Photo-ionization
- Micrometeorite impact, TD, PSD

Precipitation

- Chemical Sputtering
- ESD

Plasma-surface interaction

Particle acceleration

External field as the noise

Retrieval of internal magnetic field
Magnetospheric processes: “Why Mercury?”

1. Small size magnetosphere
2. Rich in heavy ions
3. Located in the inner heliosphere
4. Lack of the ionosphere
1 Small magnetosphere
2 Heavy ion rich
3 Located in the inner heliosphere
4 Lack of ionosphere

- 1: Deducing the kinetic-ness of the dynamics by structure function analysis

- 1 (+4?): Mercury more responsive to IMF Bz than any other planet due to high RX rate and short Dungey cycle period

- 1+3: IMF can fluctuate substantially before a Dungey cycle is completed

- 1+3: Cusp at equator, extreme events

- 1+(3+4?): The tail reconnection line position

- 1: No energetic electrons > 30 keV (but substantially amount are heated upto 10 keV)

- 1: Shabansky branching
1 Small magnetosphere
2 Heavy ion rich
3 Located in the inner heliosphere
4 Lack of ionosphere

- 2: Na⁺ ring close to the planet
- 2: Impact on boundary layer dynamics
- 2: Na⁺ seriously included in various modeling
- 2: Ca⁺ should be included
- 2: K⁺ problem @ Kaguya
- 1+2: Enough electrons for ESD

- 2: Not enough mass loading by Na⁺
- 2: The burning question: Which species, if any at all, are responsible for the mass loading?
1 Small magnetosphere
2 Heavy ion rich
3 Located in the inner heliosphere
4 Lack of ionosphere

- 1 (+4?): Mercury more responsive to IMF Bz than any other planet due to high RX rate and short Dungey cycle period
- 1(+3+4?): The tail reconnection line position at X=-2RM?!
- 3: IMF Bx important

- 4: How is FAC carried?
- 4: Surface charging
- 4: Deducing the conductivity from E&B field observations in the magnetosphere
Upon collaborating with exospheric folks

• Can’t (Shouldn’t) include every details. Need to clarify what is the essential minimum.

• The items would depend on the project that you are working on.

# Are you sure Na+ is the right one for your project?!

• Example: In my case, I want to know (1) which species is most responsible for mass loading at the magnetopause altitude and (2) what is the mass density.
Modeling efforts

• Serious studies on (1) ionospheric boundary, (2) exospheric plasma source.
• Surface potential needs to be included in particle models?
• Fluctuating IMF
• I wish to see a nice process in which the positive feed back between a plasma particle acceleration & an exospheric source process is seen.
The plasma-surface interaction theme

- MR framework: Where space, solar and lab plasma people interested in Magnetic Reconnection get together.

- Does it work for the plasma-surface theme?
  # Why was ESD overlooked? Because it is an ion source process?!
Internal magnetic field

• Removal of external field:
  - TS04 w/o RC is not satisfactory.
  - Had better concentrate on “clean” intervals.
  - Use MHD/Hybrid simulation results?!  
# Na+ ring close to the planet.