Facilitating Mercury surface process and exosphere generation research

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Mercury exospheric generation is dependant on many surface processes (sputtering, TD, MIV, PSD, ESD...)

Our understanding of these processes is rapidly evolving

Accurate understanding of surface source processes are essential for interpreting exospheric and surface observations

Exospheric models are very sensitive to representations of these processes

Therefore, we are preparing surface and exospheric models to enhance utilization of Strofio (neutral particle time-of-flight mass spectrometer) on Bepi-Columbo
Accurate understanding of surface processes is essential: Current data is limited

- Theoretical formulas often used for sputtering with assumed binding energy
  - \( f(E) \sim \frac{E^y}{(E + U)^x} \); often \( x \sim 2-3 \) and \( y \sim 0-1 \)
  - \( U \) is related to the surface binding but often just a fit parameter

- Lab results are more accurate but most deal with ices (when we do have experimental results they often differ noticeably from theoretical results; for metals the situation is better)

- Little current experimental results dealing with regolith
  - surface chemical properties and porosity can affect yields and energy spectra of ejecta significantly
Accuracy of surface processes is essential: Sputtering example

- Small changes in $U$, the binding energy, can have large impact on spatial distribution of the ejecta.
Temporal/spatial variations complicate things even more

- Nominal Na distribution for a 2500 m/s source over one mercury orbit

Co-rotation

Sun
Establishing a website

- The most accurate and up to date understanding of current state of knowledge is essential for Mercury data interpretation & research

- With these issues in mind, we intend to set up a website for Strofio but want to open it up to community

- Central database for easy determination of what we currently know and still require (assist laboratories)

- Include data and models for different surface compositions

- Possibly allow individuals to place their models on site with other users comments and critiques
What we want to store

- Sputtering/desorption (ions, electrons, photons)
  - Vs. energy, temperature, mineral type
  - Ejecta: yields, composition, charge (energy spectra)
- Adsorption: chemical & physical
  - Roles of defects & porous regolith
- Radiation enhanced diffusion & effects of charging
- Connect to reflectance spectra
- Effect of surface charging
Summary

- The proposed website is being constructed for Strofio but we hope it may be of use to the community
- Feel free to contact us for more information or with any questions (h.todd.smith@jhuapl.edu)
- Stay tuned…