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Simulation of solar system plasma environments

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The solar wind plasma interacts several ways with the Solar System bodies. The Moon does not have an atmosphere nor a global intrinsic magnetic field to protect it against the flow of the solar wind particles. Mercury does not have an atmosphere but it has a weak intrinsic magnetic field that forms a "pocket magnetosphere" around it. Venus and Mars do not have a strong global intrinsic magnetic field but they have dense enough atmospheres to produce shields against the solar wind by their ionospheres. At Mars magnetic anomalies can also form "mini magnetospheres". Titan's dense atmosphere, in turn, can meet subsonic plasma flow.

All these five objects are targets for several ESA'a and NASA'a space missions that provide plasma and magnetic field measurements: Messenger(Mercury), Bepi-Colombo(Mercury), VenusExpress(Venus), Smart-1(the Moon), MarsExpress(Mars), MGS(Mars), and Cassini(Titan). Unique data will thus be obtained from space plasma environments containing multi-ion specie plasma, direct plasma-surface interaction and direct plasma-atmosphere interaction.

In this presentation we summarize some basic properties of how the flowing plasma interacts with Mercury, Venus, the Moon, Mars and Titan. A special emphasis is placed to illustrate how these plasma environments can be studied self-consistently with 3-D quasi-neutral hybrid (electrons a fluid, ions are particles) computation models.