A MAGNETOSPHERIC SIMULATION AT THE SPACE STATION

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It is proposed that a strong magnet (terrella) be flown at or near the Space Station to create an artificial magnetosphere in a "laboratory" setting. The relative flow of the ionosphere past the terrella will constitute a plasma wind that will interact with the magnetic field of the terrella to produce a localized magnetosphere. This object could then be extensively studied using diagnostic probes attached to the Space Station, or with free flyers.

Although small in scale, such a magnetosphere would still be large compared to the gyroradius of the wind particles, as is the case in planetary magnetospheres. On the other hand the β of the plasma wind forming the magnetosphere would be much lower than the β of the solar wind for most planetary magnetospheres. Such a low β MHD interaction would expand the range of magnetospheric observations. In addition, the outside plasma flow is magnetically, rather than dynamically, dominated. This is very different from the earth's magnetosphere where the outside (solar wind) flow is dominated by the dynamic pressure of the flow. The terrella would provide our first example of such a system that we could study.

The support of the Space Station would allow all of the usual benefits to the experimenters of a laboratory; direct access to the experiment, availability of a suite of test equipment, computation and contemplation facilities, rapid turnaround and flexibility, etc. Moreover, the effects of unusual perturbations could also be studied, for example, the introduction of various heavy ions into the system. Another interesting possibility, not seen in planetary magnetospheres, is to charge the terrella to high potentials. Such an experimental setup could therefore do much to advance the general theory of magnetospheric physics.

The space and storage requirements would be minimal, since the experiment would be conducted outside the space station. The total equipment would consist of several terrellas (with varying surface conductivities), ~3 small magnetometer/plasma diagnostic packages, and several gas canisters for upstream "seeding". Power requirements would be ~60 watts. Several track-mounted tethers, each $\geq$ 200 m in length, with the track parallel to the orbital motion and 100 $\tilde{\text{m}}$ long, are also needed. Astronaut time needed would be minimal in the tethered configuration (~4 man hours/week). A free-flying configuration, while not needing the tether track, would require much more human interaction.