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Magnetospheric Auroral Asymmetry eXplorer: observing the aurora to uncover how energy flows in space

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The Magnetospheric Auroral Asymmetry Explorer (MAAX) mission makes a major leap forward in determining how magnetosphereionosphere electrodynamic coupling regulates multi-scale auroral energy flow through the near-Earth space environment. Recently proposed to NASA's Heliophysics Small Explorer program, MAAX accomplishes this by: (1) Understanding how seasons and tilt of the magnetic field regulate energy flow from the solar wind through the system; (2) discovering how the formation, evolution, and interhemispheric asymmetries of nightside meso-scale auroral features are regulated by the auroral background conductance; (3) determining how the time-dependent magnetospheric energy flow controls multi-scale auroral dynamics. The solar wind energy enters the magnetosphere mainly through dayside reconnection and is stored in the magnetosphere, which later converts to plasma and neutral thermal and kinetic energies. Dynamic smaller-scale processes in the nightside magnetosphere map from the magnetosphere to the ionosphere, resulting in auroral structures that have fascinated people for millennia. Observations of the aurora have been used as a window to probe and understand these dynamics even beyond the Earth system. The magnetic field lines in which the aurora occurs thread through both hemispheres. Traditionally, auroral observations from one hemisphere are assumed to be conjugate, while recent observations suggest this may not always be applicable. With auroral observations from one hemisphere, we can only understand some of the processes that control the flow of energy through the system. However, with observations in both with observations in both hemispheres we gain a deeper understanding into the dynamics of this integrated system. MAAX comprises two observatories in circular polar orbits at 20,850 km altitude for viewing of the auroral ovals in both hemispheres. Each observatory carries a single high-heritage UV imager to close the science objectives that operate poleward of +/-35° latitude. For the first year of the

mission, the observatories are spaced at 90° to allow continuous coverage on one oval, then the other with a 6-hour duty cycle. This phase also allows for intervals in which both view the same hemisphere or both view the same longitude but different hemispheres. For the second year of the mission, the observatories are spaced at 180° to have simultaneous complete viewing of both the northern and southern auroral ovals with a 4.5 hr/1.5 hr on/off duty cycle. Discussed here is the science motivation of the mission concept and the numerical modeling trade studies to optimize the mission characteristics to achieve the proposed objectives.