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The Dynamics of the Alfvénic Oval

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Alfvén waves are abundant in the magnetosphere and play many roles in its dynamics. Guided along magnetic field lines, Alfvén waves carry energy from one region to another, most notably towards the auroral acceleration region (AAR), a key region for magnetosphere-ionosphere (M-I) coupling. Alfvén waves represent an energy sink for other forms of energy in the magnetosphere, and therefore help to release overloading and stresses, a role related to the generation of Alfvén waves. Alfvén waves carry field-aligned currents (FACs) and are also necessary for the establishment of quasi-static FACs (also called Birkeland currents). Ultra-low frequency (ULF) pulsations on the ground and in space encompass a broad range of wave phenomena, some of which are associated with Alfvén waves. The transfer of energy from large magnetohydrodynamic (MHD) scales to smaller kinetic scales is important for the dissipation of Alfvén wave energy. Alfvén waves are an effective accelerator of both electrons and ions, some of which contribute to the aurora. Alfvén waves have been proposed to mediate reconnection. These are some of the applications of Alfvén waves, which extend beyond Earth's magnetosphere.

Furthermore, the growing recognition of the *global* role and *global* impact of Alfvén waves in the dynamics of the magnetosphere led to the concept of a global *Alfvénic Oval* (Keiling et al., 2019). This concept evolved from independent statistical studies, which showed the global morphology of Alfvén waves from space, using different satellites at different altitudes. Subsequent studies have detailed many of the Alfvénic oval's dynamic properties. In this presentation, we outline the dynamics of the Alfvénic oval as a global phenomenon in relation to different geomagnetic conditions and solar wind driving. We combine observational studies with global simulation studies that have reproduced the Alfvénic oval. The Alfvénic oval's relation to the auroral oval is also demonstrated. In the end, we will have demonstrated that the Alfvénic oval is well enough defined and that our understanding allows for the prediction of the Alfvénic oval under various conditions.

References

[1] A. Keiling, et al., "Global Alfvén wave power in the auroral zone in relation to the AE index," *Journal of Geophysical Research: Space Physics*, 124, 2019, doi.org/10.1029/2019JA026805.