This Week's Citation Classic

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Heppner J P, Sugiura M, Skillman T L. Ledley B G & Campbell M. OGO-A magnetic field observations. *J. Geophys. Res.* **72**:5417-71, 1967.

Timespace variations of the magnetic field from 16 months of measurements along the eccentric (300-150,000 Km) orbits of the OGO-A satellite were interpreted in terms of collisionless plasma interactions on both local and global scales. [The *SCI®* indicates that this paper was cited 151 times in the period 1968-1977.]

James P. Heppner
Electrodynamics Branch
National Aeronautics and
Space Administration
Goddard Space Flight Center
Greenbelt, MD 20771

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"OGO-A was neither 'first' nor 'best' in conducting space magnetic field measurements. In fact, today the mission would have been labeled a failure –particularly for magnetic field measurements, because the long, hinge-folded boom which carried our sensors (tri-axial fluxgates and an optically pumped Rb vapor magnetometer) failed to deploy. The result was that the spacecraft spun, instead of being 3-axis stabilized, and the optical pumping magnetometer was left snug against the spacecraft where it primarily 'saw' the magnetization of spacecraft parts. Fortunately the fluxgate sensors in the folded configuration were located several feet from the spacecraft in a spot where spacecraft fields were relatively weak and stable. Thus the offset zeros were tolerable (and measurable as a result of the spinning motion) and we were able to proceed with analyzing the data.

"Indirectly, selection as a 'Citation Classic' may be attributed to the failure. The long paper (54 pages, after severe cuts) could have been six or more separate papers. As we were reluctant to repeat descriptions of the data, we decided to lump the results in a single paper. Our guess is that few have read the whole but apparently many have examined individual topics.

"Why the interest? It came from two overlapping communities: plasma physicists and space geophysicists. Several results were particularly important to plasma theorists. For example, the paper provided the first detailed cross-sectional structure of collisionless shocks: in this case the bow shock which is present upstream from the earth's magnetic field in the supersonic solar wind. From a geophysical view, the most prominent result came from interpretation of sudden changes in the antisolar geomagnetic tail of the earth. This produced the concept that fields over vast regions collapse inward to a more dipolar configuration in association with auroral substorm intensifications. Although frequently confirmed, the collapse phenomenon has not been acceptably explained. In fact, because of the 'chicken and the egg' aspects of the collapse (i.e., does the collapse cause the substorm or does the substorm cause the collapse), the topic will probably remain controversial for sometime. The authors postulated that collapse is initiated by a short circuit in the ionosphere –but this left open the cause of the sudden conductivity change to produce the short-circuit."