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The Magnetospheric “Zebra Stripes”: A Tracer of Near-Earth Space Dynamics

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High-energy resolution measurements of energetic (tens to hundreds of keV) electron fluxes in the Earth’s inner radiation belt and slot region (below $L \sim 3$) revealed the presence of drift-periodic structures named the “zebra stripes”.

We show that analyzing the characteristics of the zebra stripes provides a new tool to shed light on important, yet mostly uncharted drivers of the Earth’s inner magnetosphere, namely, (a) radial displacements of geomagnetically trapped particles in the inner belt and slot region, and (b) electric field variations in the subauroral region.

With the large database of high-quality observations provided by the NASA Van Allen Probes mission, it is for the first time possible to perform long-term statistical analysis of the zebra stripe pattern.

Because Earth-like zebra stripes were also recently discovered at Saturn, the analysis of the zebra stripes present at Earth could constitute a benchmark to determine the electric fields and associated radiation belt dynamics at other magnetized planets.