LANL* V1.0: RADIATION BELT DIRFT SHELL MODELING FOR REAL-TIME AND REANALYSIS APPLICATIONS

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Radiation belt modeling requires detailed information about the particle drift shells and their spatial and temporal variations. The drift shells are commonly represented by the third adiabatic invariant, L*. Calculating drift shells in realistic geomagnetic fields are very time consuming and typically involve three-dimensional numerical integration of the global field. Choosing a simplistic but computationally less expensive geomangetic field model could lead to large inaccuracies and even wrong conclusions [Huang et al., 2008]. Efficient algorithms without the sacrifice of numerical accuracy are required especially for real-time radiation belt modeling and forecasting. Likewise, long-duration calculations (e.g. solar-cycle scales) are impractical with the standard methods. We have developed a new method for calculating accurate L* values. Our technique is based on a neural network that is 5-6 orders of magnitude faster than the standard numerical integration and interpolation. Our technique holds promise to remove a major roadblock in radiation belt research. While the technique is applicable for any closed drift shell, we will present results of a detailed validation at geosynchronous orbit. The neural network is freely available as LANL* V1.0 library. The FORTRAN library is complete with examples, Makefile for IDL and FORTRAN, and available upon request.

Geomagnetic field, drift shell modeling, adiabatic invariants

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