Effect of secular geomagnetic variation on trapped particles motion

Alvaro R. Gutierrez Falcón[1], Bruno S. Zossi[1,2,3] & Ana G. Elias[1,2,3]

[1]Departamento de Física, FACET, UNT, Argentina, [2]Laboratorio de Ionosfera, Atmosfera Neutra y Magnetosfera (LIANM), FACET, UNT, Argentina, [3]INFINOA, CONICET-UNT, Argentina

Abstract:

Particles trapped by the geomagnetic field have a trajectory that can be described by three cyclic motions: gyration, bounce along field lines, and drift around the earth, which are all controlled by this field. The geomagnetic field, in turn, has been weakening at a rate of ~5% per century since at least ~1840. This may point out an undergoing polarity reversal, or maybe the possibility of a future switch of this decreasing trend with a field recovery. In any case, the global field intensity will very probably continue to decrease in the near future with a consequent weakening of our planet's magnetic shield capacity. A possible future scenario is a steady decrease of the dipole component with an increasing field complexity through the growth of non-dipolar components. The expected variations in trapped particle trajectories, which describe an overall drift shell, are assessed, consisting mainly in a decrease of the drift shell mean distance and of mirror point altitudes, together with an increase of conjugate mirror points asymmetry. The idealized and simplified structures here analyzed could shed light on the study of plausible radiation belt changes during polarity transitions which may surely have implications for outer-space technologies.

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