



Effects of the Oxygen ion torus on the propagation of electromagnetic ion cyclotron waves

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The idea of a bouncing wave packet, that travels along the geomagnetic field between the northern and southern hemispheres, was put forward in the 1960s to explain signals at a frequency of about 1 Hz measured in the Antarctic. These signals, known as pearls, are electromagnetic ion cyclotron waves that cause electron loss from the radiation belts. However, the bouncing wave packet idea could not explain the non-dispersive nature of the signals nor account for satellite observations which show that energy flow is always away from the magnetic equator towards the ground. Several other theories have been put forward, but none have been able to explain all the properties of the signals and so the origin of these waves remains a mystery. Here we show how the formation of an Oxygen ion torus after a geomagnetic storm affects the propagation of ion cyclotron waves. We show how the torus results in bouncing wave packets and we discuss the dispersive nature of the waves. We show examples of how the waves can be guided by such a torus. We include a non-dipole magnetic field and show how this affects the propagation and energy flow of the waves. Finally, we discuss whether our findings can re-ignite the idea of bouncing wave packets compared to other theories.