

Topside Plasma Bubbles, seen as He^+ Density Depletions: Estimations of Life Time

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The study deals with the evaluation of the survival possibilities of the plasma bubbles, seen as He^+ density depletions in the topside ionosphere. He^+ density depletions (or subtroughs) are usually observed during a high solar activity at the topside ionospheric altitudes (~ 1000 km) deeply inside the plasmasphere ($L \sim 1.3-3$). They are considered as originating from equatorial plasma bubbles phenomena or as possible fossil bubble signatures) [1, 2]. The estimation of the characteristic times of a life, diffusion and vertical drift transport of helium ions (He^+) at the topside ionosphere heights of the low-/mid-latitude region was made. It is revealed, that the diffusion transport process is the fastest one (some minutes). Since the ionosphere plasma is magnetized plasma at the topside ionosphere heights, the diffusion processes are field-aligned. Plasma bubbles spread (due to diffusion processes) along the magnetic tubes. Their spreading becomes more and more significant in process of their uplifting. So extended bubbles look like 'banana' with the extremities reaching the ionosphere heights in both the hemispheres. This scheme is also correct if the separate components are under considerations, namely He^+ . On the other hand, it is well known, that the magnetic tube, partially "devastated" by a plasma bubble, is replenished extremely slowly. The tube replenishment time is proportionally L^4 (i.e. Badin [3]). For example, it takes ~ 10 hours for refilling the tube ($L=2$, $\sim 45^\circ \text{INVLAT}$), partially "devastated" or depleted by plasma bubble. It was concluded, that, if some plasma bubbles can reach the topside and plasmasphere heights, they can exist here (may be as "dead" bubbles) during some hours. It was also concluded, that there is enough time to register the plasma bubbles at the topside ionosphere heights.

Keywords: He^+ density depletions; plasma bubbles; topside ionosphere.

References

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