

Observation of Thermal Cavities during HF Modification of the Ionosphere

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The ionosphere can be considered a natural plasma laboratory of great size with no boundaries and an excellent plasma confinement. During ionospheric modification experiments with long-time, high-power high-frequency (HF) radio wave heating, large-scale (over a few tens of kilometers) density depletions (nearly 50% density modification) have been observed. Basic processes of this phenomenon can be understood in terms of the Ohmic heating of the plasma near the HF reflection layer and the subsequent plasma expulsion from this layer. As a result, these density depletions are dubbed thermal cavities.

The results of ionospheric modification experiments performed at Arecibo Observatory, Puerto Rico, have revealed that 1) the increase in the electron temperature near the HF reflection layer is roughly 5 times the initial value, 2) radar observations suggest the existence of strong ion turbulence inside thermal cavities, and 3) thermal cavities can interact with naturally generated density bubbles.