

ARTIFICIAL MODIFICATION OF THE MAGNETOSPHERIC CYCLOTRON MASER OPERATION

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Problem Statement

The space project RESONANCE is directed to the study of wave-particle interactions and plasma dynamics in the inner magnetosphere. The main goals of the RESONANCE project are the following:

1. Long-term observations of the natural phenomena:
 - a. Dynamics of magnetospheric cyclotron maser,
 - b. Ring current formation,
 - c. Refilling of plasmasphere after magnetic storms,
 - d. Study of the role of the small-scale phenomena in the global plasma dynamics.
2. An artificial influence on the operation of magnetospheric maser. Basic options following are:
 - a. Artificial excitation and/or stimulation of wave modes;
 - b. Modification of the flux of precipitating particles;
 - c. Variation of maser Q-factor by modifications of the reflection index at the ionospheric footprint of the selected magnetic flux tube.

Mission Scenario

Two satellites will be launched in the magneto-synchronous orbit, conjugated to the ground based heating facility HAARP. Satellites will be located up to forty minutes in the flux tube, with footprint in the ionosphere over the heater: while one of them will be in the northern hemisphere, another one will be in the southern.

“Active” pars of the scientific programme

The “Active” part of the measurements will focus on the joint experiments of the RESONANCE satellite(s) and a ground-based HF heating facility. This experiment is based on the possibility that parameters of the natural magnetospheric oscillatory systems can be changed by the artificially ionospheric modification. Powerful HF electromagnetic emissions will heat the ionosphere, and modulate the ionospheric mirrors for the cyclotron waves. This will permit the evaluation of important underlying principles in the cyclotron maser theory and clarify the role of ionospheric mirrors in wave generation. In the case of in-phase modification, the amplitude of the natural oscillations will be increased and inversely, anti-phase modification will decrease the oscillation. Natural magnetospheric oscillations will be measured onboard the RESONANCE satellite. Results of these measurements will be transmitted to the receiving station near the heating facility, and will be used to modulate the HF radiation. In this experiment the telemetry line (with a controlled phase shifter), connecting the satellite and the heating facility, will regulate the feedback superimposed on the existing natural feedback of the magnetospheric oscillatory system.

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