



Importance of in-situ space plasma studies for our understanding of natural masers phenomenon

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The fact that natural masers exist in the Universe is one of the most unexpected discoveries made by astrophysicists in 20th century. Sites of maser emission include: planetary magnetospheres, comets, star-forming regions, circumstellar envelopes of red giant stars, supernova remnants and discs in the centers of active galaxies. In-situ measurements are the best way to understand the natural masers phenomenon. The only natural masers that can be studied experimentally in-situ are magnetospheric masers. Significant manifestation of cyclotron maser instability in the Earth's magnetosphere is Auroral Kilometric Radiation (AKR) – the most powerful natural emission in the near-Earth plasma. These waves were discovered 40 years ago but even today their origin and properties remain a mystery in many respects.

The forthcoming RESONANCE project will provide the opportunity for multipoint measurements of waves and plasma processes involved in magnetospheric masers phenomenon. It will allow detailed in-situ studies of resonant wave-particle interactions that excite AKR in auroral region of the magnetosphere. Methods of linear and nonlinear processes identification that quantify the dynamics of plasma waves generated by magnetospheric masers are considered. These techniques allow differentiating between the linear wave-particle interaction and nonlinear processes of energy transfer in plasma turbulence.