THIN PLASMA CAVITIES AS A SOURCE OF AURORAL KILOMETRIC RADIATION

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During the last years it was found that sources of the Auroral Kilometric Radiation (AKR) are thin plasma cavities, filled by hot and tenuous plasma, separated from the denser and colder surrounding plasma by sharp density gradients. In the light of recent experimental observations, the waveguide model of the AKR generation describing the development of the electron cyclotron maser instability in sources of finite perpendicular extension is studied. The general dispersion equation descriptive of wave propagation in an arbitrary direction is obtained. It is shown that the main effect arising from a finite geometry of AKR sources is an existence of a preferential direction of wave generation inside the source: the instability growth rate is increased as the wave vector component directed along cavity boundaries increases. The eigen waveguide modes are found and it is demonstrated that a structure of electromagnetic field is asymmetric inside the source for general case. The wave polarization is strongly coordinate dependent and the electric field component transverse to the source boundary may be significantly greater than the component directed along the boundary. Calculations of wave amplification factor under assumption of geometric optics have shown that it may reach high values during the wave propagation inside the source. However, waves usually do not reach altitudes, where their frequency becomes equal to the local cutoff frequency in the surrounding cold plasma. So, special attention is paid to the problem of wave escape from the source. It is shown that the role of time dependent processes in wave escape and formation of AKR radiating diagram is very essential. In particular the investigation of wave scattering at the waveguide frontier in the presence of low frequency fluctuations has shown that an energy transmission coefficient has the greatest values for waves propagating at rather small angles about the magnetic field. The comparison of obtained results with experimental data is discussed.The work is supported by grant RFBR 06-02-72560.