conditions of stabilization of quasi-flutelike microinstabilities in an neutron source based on gas-dynamic trap

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Sources of the thermonuclear neutrons based on a mirror trap are considered as a possible way of utilizing axisymmetric mirror traps now. Such sources can be used for material science and as driver for subcritical hybrid. For example, since the 80s, conception of neutron source based on gas-dynamic trap is developed in Budker INP. The population of fast sloshing ions providing thermonuclear reaction is generated in this source through skew neutral-beam injection. Parameters achieved in the GDT device allow neutron source for material science to be constructed, the driver for subcritical hybrid can be constructed after some extrapolating parameters [1].

In such a source, ion distribution function will differ essentially from the Maxwellian distribution. Also, plasma radius will be comparable with the ion Larmour radius. These conditions are favorable for excitation of such microinstabilities as Drift-Cyclotron Loss-Cone (DCLC) and Double-Humped (DH) instabilities [2]. Excitation of DCLC and DH instabilities results in generating flute-like waves which has frequency near ion-cyclotron frequency. These waves can provoke anomalous ion scattering and influence on energy and particle transport. Most popular method of stabilizing the DCLC instability is filling loss cone by warm ions, but this method can lead to excitation of DH instability, which is driven by difference between average transversal velocities of warm on hot ions. So parameters of neutron source must be not only optimal for neutron producing, but also favorable for DCLC and DH stabilization.

Present work is devoted to investigating stability of flute-like microinstabilities in a mirror trap with skew neutral-beam injection. Ion distribution function and parameters of neutron source are chosen from comparison with results of numerical simulation based on DOL code [3]. The dispersion relation is derived in the slab approximation [2]. Stabilizing effect of increasing warm ions temperature is demonstrated, influence of ions isotopic composition is investigated, parameters of neutron source favorable for DCLC and DH stabilization are found.

References

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