



專題演講

Study of the absolute instability in a finite plasma system – The gyrotron backward oscillator as an example

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Place : 健雄館(科四館) S4-811 教室

摘要/Abstract :

The gyrotron backward wave oscillator is a unique and slow-developing version of gyrotron devices due to its relatively less explored physics based on the absolute instability in a finite plasma system.

Employing two-scale-length expansion, an analytical linear dispersion relation corresponding to the absolute instability in a finite plasma system has been derived in our recent study of gyrotron backward wave oscillators (gyro-BWO). Detuning from the beam-wave resonance condition due to the finite amplitude radiation fields, meanwhile, was found to play the crucial roles in the nonlinear physics. Near the start oscillation of the gyro-BWO, the radiation field amplitude saturates when the resonance broadening is comparable to the linear growth rate. Far beyond the start oscillation threshold, the beam-wave resonance detuning effectively shortens the interaction length toward the value corresponding to the critical oscillation length for the given beam current.

The time-dependent simulation was performed for studying the nonstationary behaviors of the gyro-BWO. The numerical results show that the backward propagating radiation generated in the minor field structure near the downstream end of gyro-BWO can interfere the beam-wave interaction in the contracted interaction region. The resulting field amplitude fluctuation in the contracted region thus causes the self-modulation in gyro-BWO.

Exploration of the fundamental physics underpinning the absolute instability in a finite plasma system helps reveal the physical reason for the nonstationary oscillation of the gyro-BWO.

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