誘電体装荷導波管内でのビーム・プラズマ不安定性による高出力ミリ波放射の増大

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1998 Fiscal Year Final Research Report Summary

ENHANCEMENT OF HIGH-POWER MM WAVE RADIATION BY THE BEAM-PLASMA INSTABILITY IN A DIELECTRIC-LOADED WAVEGUIDE

Research Project

Project/Area Number

09680457

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Single-year Grants

Section

一般

Research Field

プラズマ理工学

Research Institution

KANAZAWA UNIVERSITY

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Keywords

microwave generation / intense relativistic electron beam / Cherenkov instability / cyclotron-Cherenkov instability / plasma-filled waveguide / beam-plasma instabilities / current amplification

Research Abstract

1. THEORETICAL ANALYSIS
(1) We derived a dispersion relation for waves excited by an intense monoenergetic linear relativistic electron beam (IREB) in a plasma-filled dielectric-lined cylindrical waveguide immersed in a finite magnetic field. Finding is that, in addition to the Cherenkov and cyclotron-Cherenkov instabilities which can be excited in a vacuum waveguide, the beam-plasma instabilities are also excited. These instabilities are due to coupling of slow space-charge waves and slow cyclotron waves on the beam with Trivelpiece-Gould modes in the plasma.
(2) We analyzed numerically the dispersion relation and derived frequencies and growth rates of these instabilities.
(3) When the plasma frequency is lower than the electron cyclotron frequency, enhancement of the growth rates of the Cherenkov and the cyclotron-Cherenkov instabilities due to presence of the plasma are not observed. However, when the plasma frequency is higher than the cyclotron frequency, the growth rates of both in ⋯▾ More

Research Products (4 results)

All | Other

All | Publications (4 results)

[Publications] M.MASUZAKI et al: "Linean analysis of instabilities in a plasma-fieled dielectric-lined circular waveguide immersed in a finite axial magnetic field"to be published in Proc. of the 12th Intern.couf.on High-Power Particle Beams.

[Publications] H.Tsukuda,M.Masuzaki et al.: "Instabilities driven by anintense beam in a plasma-fieled dielectric-lined waveguide immersed in a finite axial magnetic field."Proc.of 21st Intern.Free Electron Laser Conf.. (To be published).

[Publications] M. Masuzaki, H. Tsukuda, N. Toyosugi., K. Kamada, R. Ando, and T. Watanabe.: "Linear analysis of instabilities in a plasma-filled dielectric-lined circular waveguide immersed in a finite axial magnetic field."Proceedings of the 12th International Conference on High-Power Particle Beams (Haifa, Israel,). (To be published). (1998)

[Publications] H. Tsukuda, M. Masuzaki, M. Matsuoka, N. Toyosygi, C. Y. Lee, R. Ando, K. Kamada, and T. Watanabe: "Instabilities driven by an intense beam in a plasma-filled dielectric-lined waveguide immersed in a finite axial magnetic field."Proceedings of 21st International Free Electron Laser Conference (Hamburg, Germany.). (To be published). (1999)

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