大強度相対論的電子ビーム・プラズマ系における乱流電場の分光測定

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雑誌名	平成3(1991)年度 科学研究費補助金 一般研究(B) 研究成果報告書概要
巻	1990　1991
ページ	2p.
発行年	1994-03-17
URL	http://doi.org/10.24517/00067315

1991 Fiscal Year Final Research Report Summary

Spectroscopic Measurements of Turbulent Electric Fields in An Intense Relativistic Electron Beam-Plasma System

Research Project

Project/Area Number

02452271

Research Category

Grant-in-Aid for General Scientific Research (B)

Allocation Type

Single-year Grants

Research Field

プラズマ理工学

Research Institution

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Project Period (FY)

1990 – 1991

Keywords

INTENSE RELATIVISTIC ELECTRON BEAM / STRONG LANGMUIR TURBULENCE / TURBULENT ELECTRIC FIELDS / PLASMA SATELLITE / STARK SHIFT

Research Abstract

The main purpose of this research project was to establish spectroscopic methods for measurements of turbulent electric fields in an intense relativistic electron beam-plasma system. Followings are summary of results obtained: 1. An 8-channel spectroscopic system composed of a 0.5 m Ebert-type monochromator(Jarrell-Ash), a rod lens, a fiber bundle and eight photomultipliers has been prepared. Resolution of each channel is 0.03 nm and the minimum separation between neighboring channels is 0.04 nm. 2. Forbidden lines 447.0 nm and 667.8 nm were observed near He I 447.2 nm and 492.2 nm lines, respectively, when an intense beam was injected into a plasma produced in helium gas of 20 m Torr by a pair of plasma guns. The appearance of forbidden lines is an evidence of the turbulent state of the plasma. 3. It was found from Stark shift measurements that there were electric fields even as high

as 110-125 kV/cm, and that the distribution of the electric fields was a Gaussian. 4. The turbulent state continued to exist even about 1 mus after the beam ceased to propagate. 5. The results of spectroscopic measurements may be explained by the recently proposed two-component model which states that there are many cavitons in the plasma which repeat creation by nucleation, collapse and burn out, and that the turbulent state consists of cavitons and background weak waves. 6. A N_2-laser for pumping a dye laser was fabricated. The dye laser is to be used for a plasma satellite method with laser induced florescence. 7. When the ratio of the beam electron density and the plasma electron density was higher than about 0.01, high-power broadband microwaves were emitted, and current enhancement phenomenon appeared. However, there was no dependence on this density ratio of the results of the spectroscopic measurements.

Research Products (4 results)

All | Other

All | Publications (4 results)

[Publications] M.MASUZAKI: "An experimental study of strong turbulence driven by an intense relativistic electron beam" To be published in “Proc, of the 9th International Covcterence on High-Pocoer Particle Beams" (May 25-29,1992,Washington).

[Publications] M.YOSHIKAWA: "Spectroscopic system for measurements of turbulent electric fields originating form inteuse relativistic clectron beam-plasma interactions" To be published in Jap.J.Appl.Phys.32. (1993)

[Publications] M. Masuzaki, R. Ando, M. Yoshikawa, H. Morita, J. Yasuoka and K. Kamada: "An experimental study of strong turbulence driven by an intense relativistic electron beam." Proc. Int. Conf. High-Power Particle Beams(May 25-29, 1992, Washington).

[Publications] M. Yoshikawa, R. Ando and M. Masuzaki: "Spectroscopic system for measurements of turbulent electric fields originating from intense relativistic electron beam-plasma interactions." Jap. J. Appl. Phys 32. Part 1, No. 2. (1993)

URL: https://kaken.nii.ac.jp/report/KAKENHI-PROJECT-02452271/024522711991kenkyu_seika_hokoku_

Published: 1994-03-17