

\$10. Technology Related to High Power Micro-, Millimeter- and TeraHertz-Waves, and Its Application to Plasma Heating and Diagnostics

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i) Objectives

In LHD experiments, a Mega-Watt millimeter wave system (77 GHz and 154 GHz) has been used for strong electron heating and current drive and, recently, is used for a diagnostic power source such as the collective Thomson scattering (CTS). In the diagnostic aspects, electron temperature profiles and temperature fluctuations are measured using electron cyclotron emissions (ECE) from a plasma over a millimeter-wave range. The millimeter-wave reflectometry is also used to measure the electron density fluctuation to analyze the turbulence in the plasma.

In these days, microwave, millimeter-wave and TeraHertz-wave oscillators and some components have been progressively developed and applied to plasma, material and medical sciences.

The objective of this workshop is to promote the exchange of the state-of-the-art informations among the researchers of micro-, millimeter- & TeraHertz-waves for the improvement in each field and the development of the new collaborative research.

ii) Activities in FY2015

In this fiscal year, we intended to collect information and to make intensive discussion of the latest research results and the new research trend of the generation, detection and application of millimeter- / micro-waves and also TeraHertz-waves. Main themes in this fiscal year are as follows,

1. Present status of the research, development and manufacturing of micro-, millimeter- & TeraHertz-wave power sources and components.
2. Application of new ideas and technologies in high power micro-, millimeter- & TeraHertz-wave power sources and components to the fusion research and to the other research fields.

We had a workshop in January 20th, 2016 under the keywords of “Technology Related to High Power Micro-, Millimeter- and TeraHertz-Waves and Its Application to Plasma Heating and Diagnostics”. The workshop included nine recent research reports by collaborators.

The participants distributed over wide area related to the micro-, millimeter- & TeraHertz-wave technology and its application. About 21 members joined the workshop. The presentation materials were summarized and distributed in the CD-ROM for convenience.

iii) Brief Summary of the Presentations

In the workshop, recent research activities were reported by the following researchers. Their presentations covered the power source development, method of analysis and application of millimeter-/ TeraHertz-waves. The topics are widely spread, for example, gyrotron development for ITER and JT-60SA, development of millimeter-wave components and so on. We hope the expansion of research field, new idea and new future collaboration through the information exchange among the researchers in the various research fields related to power sources, detectors, theories about micro-, millimeter- and TeraHertz-waves.

There were nine presentations. The presentation title and presenters are listed below.

Presentations: Recent Research Reports

1. “Development of an ECH System in QUEST”
by Dr. H. Idei, Research Institute for Applied Mechanics, Kyushu University.
2. “Present Status of of 300 GHz Gyrotron Development for Collective Thomson Scattering Diagnostics in LHD”
by Dr. T. Saito, Fukui University.
3. “Development, Progress, and Procurement of ITER Gyrotrons and Equatorial Launcher”
by Dr. R. Ikeda, Japan Atomic Energy Agency.
4. “Research and Development of Devices for High Power Millimeter Wave ”
by Dr. M. Saigusa, Ibaraki University.
5. “Development of a Low-Loss Polarizer in Millimeter-Wave Range ”
by Dr. T. Tsujimuraa, National Institute for Fusion Science.
6. “FDTD Analyses of the Electromagnetic Waves in a Miter-Bend and a Miter-Bend Type Polarizer ”
by Dr. Y. Fujita, Nagoya University.
7. “Generation of High Power TeraHertz Waves Using a Cylindrical Surface-Wave Resonator ”
by Dr. K. Ogura, Niigata University.
8. “Analyses of Frequency and Amplitude of Coherent Transition Radiation Generated by a Pulsed Electron Beam”
by Dr. K. Kan, The Institute of Scientific and Industrial Research, Osaka University.
9. “Generation of THz Radiation by Surface Plasmon-Polariton on the Graphen”
by Dr. D. Li , Institute for Laser Technology.