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EX/10-1: Is Turbulence Determined by Local Temperature Gradient?

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Here we report dynamic response of micro-fluctuations and turbulent flux to a low frequency heat wave induced by the ECH modulation and development of observation of low frequency fluctuation with long distance radial correlation length comparable to the plasma radius (long-range mode) in LHD. A low frequency global wave is excited by central ECH power modulation at 25 Hz. The typical low-density L-mode NBI plasmas are chosen as targets. Density fluctuation is measured with an O-mode reflectometer and time evolutions of temperature and temperature gradient are measured with a 28-channel radiometer. Experimental observations show that (i) the responses of heat flux and micro-fluctuation amplitudes to the change in temperature gradient have hysteresis characteristics and (ii) the long-range mode is a possible candidate to explain a correlation between micro-fluctuations at distant positions. These results deny the local transport model, where turbulence is determined by local temperature gradient, and strongly suggest that turbulence should be determined by global interactions within the radial correlation length.
This study pioneers research of the following fundamental processes for turbulence transport, i.e., (1) dynamics of micro-fluctuations, (2) relations between turbulent flux, fluctuation amplitude and local temperature gradient, (3) comprehensive observations of low frequency long-range modes. These results will open the way to understand physical mechanics of turbulence transport. This is beneficial for turbulence control in future burning plasmas.

Country or International Organization of Primary Author

Japan

Primary author: Mr INAGAKI, Shigeru (Japan)

Co-authors: Prof. FUJISAWA, Akihide (Kyushu University); Dr SHIMIZU, Akihiro (National Institute for Fusion Science); Dr TSUCHIYA, Hayato (National Institute for Fusion Science); Prof. YAMADA, Hiroshi (National Institute for Fusion SCience); Prof. IDA, Katsumi (National Institute for Fusion Science); Prof. KAWAHATA, Kazuo (National Institute for Fusion Science); Dr TANAKA, Kenji (National Institute for Fusion Science); Prof. ITOH, Kimitaka (National Institute for Fusion Science); Dr KASUYA, Naohiro (National Institute for Fusion Science); Dr TAMURA, Naoki (National Institute for Fusion Science); Prof. ITOH, Sanae-I. (Kyushu University); Prof. SUDO, Shigeru (National Institute for Fusion SCience); Prof. KUBO, Shin (National Institute for Fusion Science); Prof. SHIMOZUMA, Takashi (National Institute for Fusion Science); Dr IDO, Takeshi (National Institute for Fusion Science); Mr KOBAYASHI, Tatsuya (Kyushu University); Dr TOKUZAWA, Tokihiko (National Institute for Fusion Science); Prof. NAGAYAMA, Yoshio (National Institute for Fusion Science)

Presenter: Mr INAGAKI, Shigeru (Japan)

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