Contribution ID: **141** Type: **Poster**

EX/P3-09: Understanding the Dynamics of Cold Pulse Nonlocality Phenomena

Wednesday, 10 October 2012 08:30 (4 hours)

Resolving the long standing question of whether tokamak transport is local or non-local is crucial for successful predictive modeling of ITER. Though most theoretical and modeling schemes are based on the local Fickian formulation, there are many conspicuous experimental results suggesting otherwise. Most notable of these is the cold pulse nonlocality in which edge cooling produces a central temperature rise on a time scale drastically shorter than the bulk confinement time. In this paper, we present experimental and theoretical results which illuminate the enigma of the cold pulse and support the hypothesis that the associated central temperature rise is due to the formation of a transient thermal barrier structure. We present fluctuation measurements which support this conclusion. Experiments show that Supersonic Molecular Beam Injection (SMBI) into a LOC plasma results in fast edge cooling and the subsequent central heating. Sequential SMBI sustains the elevated core temperature if the interval between SMBI pulses is shorter than one confinement time. Microwave reflectometry studies of the response of core turbulent density fluctuations to SMBI show that small scale, high frequency fluctuations are reduced in this state with sustained increase of Te(0). Theoretical studies have focused on the elucidation of the origin of the rapid profile response to the peripheral cooling. Studies of model simulations of cold pulse experiments recover all of the elements of non-locality –i.e. the inversion, a transient thermal barrier due to the self-consistent shearing and a fast response. Further studies reveal that the key to the inversion and transient thermal barrier is diamagnetic shearing, self-consistently produced in response to dynamic profile perturbations. Thus, we propose that the long standing mystery of turbulent non-locality phenomena is ultimately rooted in a simple but strongly nonlinear feedback loops in the transport dynamics, and that dynamic shearing can produce the transient barrier structures required to explain the cold pulse phenomenology.

Country or International Organization of Primary Author

China

Collaboration (if applicable, e.g., International Tokamak Physics Activities)

HL-2A, kSTAR

Primary author: Mr SUN, Hongjuan (Republic of Korea)

Co-authors: Mr FENG, Beibin (Southwestern Institute of Physics); Mr CHEN, Chenyuan (Southwestern Institute of Physics); Dr HOGEWEIJ, G M D (DIFFER, the Netherlands); Dr KWAK, J G (National Fusion Research Institute); Mr CITRIN, Jonathan (DIFFER, the Netherlands); Dr ZHOU, Jun (Southwestern Institute of Physics); Dr YAO, Lianghua (Southwestern Institute of Physics); Prof. DIAMOND, Patrick H. (NFRI, UCSD); Dr LEE, S G (National Fusion Research Institute); Dr YOON, Siwoo (National Fusion Research Institute); Dr KIM, W C (National Fusion Research Instiitute); Mr HUANG, Xianli (Southwestern Instittute of Physics); Dr SONG, Xianmin

(Southwestern Institute of Physics); Prof. DING, Xuantong (Southwestern Institute of Physics); Dr ZHOU, Yan (Southwestern Institute of Physics); Dr WANG, Zhanhui (Southwestern Institute of Physics); Dr SHI, Zhongbin (Southwestern Institute of Physics)

Presenter: Mr SUN, Hongjuan (Republic of Korea)

Session Classification: Poster: P3

Track Classification: EXC - Magnetic Confinement Experiments: Confinement