IAEA FEC 2014

Contribution ID: **121**

Type: **Poster**

# Influence of Flow Shear on the Structure of Ion-Scale Turbulence in MAST

*Wednesday 15 October 2014 14:00 (4h 45m)*

In support of our goal to develop a predictive capability for turbulent transport close to threshold, a 2D BES diagnostic has been used to study the structure and dynamics of the ion-scale turbulence in MAST. Our previous work has shown this turbulence to be critically balanced, i.e. exhibiting a balance of linear timescales. Here, this work is extended to study the influence of flow shear on the radial/poloidal structure of the turbulence. The resulting eddy 'tilt'is found to increase with the product of the shearing rate and correlation time, while the poloidal wavenumber decreases and the radial correlation length unexpectedly remains quite constant. These observations are consistent with a concomitant decrease of the turbulent ion heat flux.
Local, non-linear, gyro-kinetic simulations using GS2 for the periphery of an L-mode plasma, in which the flow shear is varied while holding other gradients fixed, show that the turbulent heat flux reduces sharply close to the experimental shearing rate. Furthermore, turbulence is excited even below the ion temperature gradient required for linear instability, indicating that this turbulence is sub-critical. For comparison with observations, the simulated density turbulence is processed using a 'synthetic'BES diagnostic and subsequently analysed with similar correlation techniques to those used for the experimental data. Initial results exhibit a similar increase of the eddy tilt with flow shear to that found experimentally.
Work is also underway to determine the properties of ion-scale zonal flows from the BES and other turbulence data. Such zonal flows are due to radially localized potential fluctuations, constant on a flux surface, which are believed to play an important role in the turbulent dynamics, particularly under conditions close to marginality. Initial results from L-mode plasmas indicate significant power in perpendicular velocity fluctuations at frequencies below 2 kHz, which is also observed in data from a Doppler Back-Scattering (DBS) reflectometry system. Detection of significant coherence between these toroidally displaced measurements is also required to confirm whether the observed velocity fluctuations are due to zonal flows.

This work was part funded by STFC, the RCUK Energy Programme, the European Union's Horizon 2020 Programme, the US DOE DE-FG02-99ER54527 and HAS.

## Country or International Organisation

UK

## Paper Number

EX/P4-38

**Author:** Dr FIELD, Anthony (CCFE)

**Co-authors:** Dr SCHEKOCHIHIN, Alexander (Rudolf Peierls Centre for Theoretical Physics, University of Oxford, Oxford, UK); ROACH, Colin (Culham Centre for Fusion Energy); Dr DUNAI, Daniel (Wigner Research Centre for Physics, Hungarian Academy of Science, Budapest, Hungary); Dr HIGHCOCK, Edmund (Rudolf Peierls Centre for Theoretical Physics, University of Oxford, Oxford, UK); Dr PARRA, Felix (Rudolf Peierls Centre for Theoretical Physics, University of Oxford, Oxford, UK); Mr VAN WYK, Ferdinand (Rudolf Peierls Centre for Theoretical Physics, University of Oxford, Oxford, UK); Dr HILLESHEIM, Jon (Culham Centre for Fusion Energy, Abingdon, UK); Mr FOX, Michael (Rudolf Peierls Centre for Theoretical Physics, University of Oxford, Oxford, UK); Dr CROCKER, Neal (University of California Los Angeles); Dr PEEBLES, Tony (University of California, Los Angeles, California, USA); Prof. GHIM, Young-chul (KAIST, Daejeon 305-701, Republic of Korea)

**Presenter:** Dr HILLESHEIM, Jon (Culham Centre for Fusion Energy, Abingdon, UK)

**Session Classification:** Poster 4