Propagating Blobs

Reference probe at fixed location, multi pin probe is moved radially between discharges

100

Region of high field strength

Increasing magnetic Hill increases turbulent flux

13

A Hill discharge with a GAE shows sensitivity to good/bad

0.1

x 10

10

Earlier single probe measurements (see poster [PP1.046]) showed the same:

More in

100 – E

cm

Langmuir probes

14

Influence of magnetic Hill, Well and Mirror fields

Parallel correlation and phase difference for long connection

Seven pins on the multi pin probe configured for ion saturation current measurement, eight for floating potential measurement

x 10

-0.05

High densities

2D correlation analysis yields density and potential structures

11

140

First results

with multiple

4

= 10

120

Multi pin multi probe operation possible without disrupting

Relationship of density and potential structures

Conclusions

Multi pin multi probe operation possible without disrupting macroscopic plasma parameters

12.5

25 GHz

-2

5 dBm

Experiment and Probes

Overview

- Look at fusion plasma edge turbulence with multiple multi-tip Langmuir probes
- Correlation with fixed reference probe on connecting field line gives 2D spatial resolution ⇒
  - Propagating Blobs
  - Relationship of density and potential structures (crossphase)
- First results
- Particle transport measurement with probes:
  - Influence of magnetic Hill, Well and Mirror fields on the flux frequency spectrum

Ground Plane

Quasi Helically Symmetric Mode (QHS)

At medium density (10^15 cm^-3), a Blob moves upward and slightly inward

At high density (2 \times 10^15 cm^-3), movement is reversed to downward and outward

Mirror Mode (Symmetry DELIBERATELY Broken by Mirror Fields)

At medium density (10^15 cm^-3), a smaller Blob moves like in the QHS medium density case

- In all cases, there is a weak dipole present
- Potential and Density Blobs are nearly on top of each other (no large cross phase)
- This first result hints at the drift wave / trapped electron family of instabilities, not the ballooning / interchange kind

Transport

- Data taken with 4 pin probes at the low field side (LFS) and high field side (HFS) of r/a = 0.5, with a small further in for the low field side probes
- Parallel flux from second order fluctuations is estimated with a three point Langmuir probe

\[ \rho = \rho_0 + \rho_1 \theta + \rho_2 \theta^2 \]

where \( \rho_0 \) is the density of the background plasma.

- Fluctuations are neglected

- Direction of transport depends on signs of crossphase \( \theta \)

Adding a magnetic Hill increases turbulent transport at high densities

High and Low Field Side have similar spectra

Except at GAE Mode ⇒ Flux Reversal

Conclusions

- More in-depth look at influence of Mirror fields and magnetic Hill and Well on Blob dynamics
- Comparison with turbulence models (see poster [PP1.046] in this session)
- Parallel correlation and phase difference for long connection lengths, GAE mode (see posters [PP1.044] and [PP1.045])
- Wave number spectra and scaling
- New fluctuation diagnostic for core turbulence: Reflectometry

Future Work

Contact Author: chichte@wisc.edu

Planned Reflectometer

- 5-50 kHz band shown
- A Mode for MWG plasma
- A Mode for high density: Titerate possible
- Use backwards look to measure three wave imaging Reflectometry (S3R)

Experiment and Probes

HSX has a Helically Symmetric Field

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- Use backwards look to measure three wave imaging Reflectometry (S3R)
- Radial blob moved by E x B drift from accompanying potential blob
- Net radial flux because density blob slightly off-center
- Reversal of motion going from low to high density
- Transport increases with Hill strength
- Flux at GAE mode reverses at high field side