

Research & Pedagogical activity

Status and Plans

N. Vianello

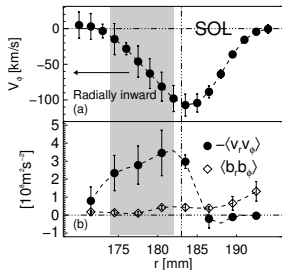
Personal research interest

- ▶ I've been active in fusion plasma physics since the M.Sci. thesis in 1999
- ▶ Personal research interests can be described in three main macro-areas
 - (A) Turbulence & Flows in magnetized plasmas
 - (B) Statistical characterization of electromagnetic fluctuations
 - (C) Emerging of electromagnetic structures
 - (D) Spontaneously developed Helical plasmas

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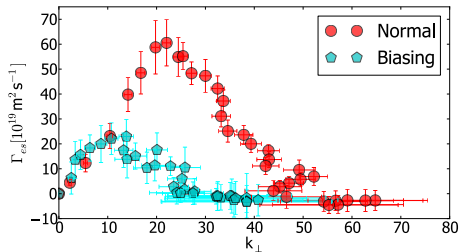
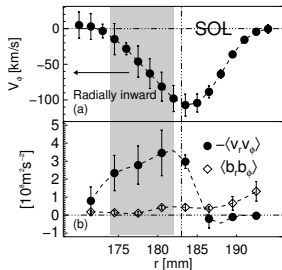
(i) Role of electrostatic Reynolds stress in momentum generation in RFPs



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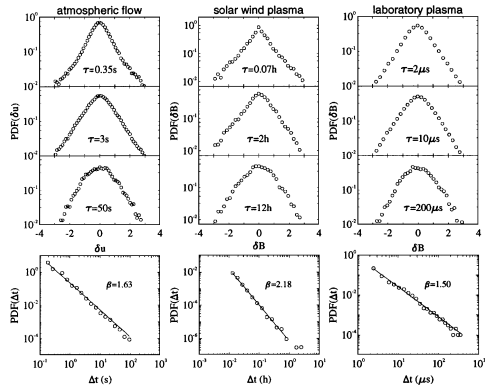
(i) Role of electrostatic Reynolds stress in momentum generation in RFPs

(ii) Transport reduction induced by active modification of sheared flow



Intermittency & SOC

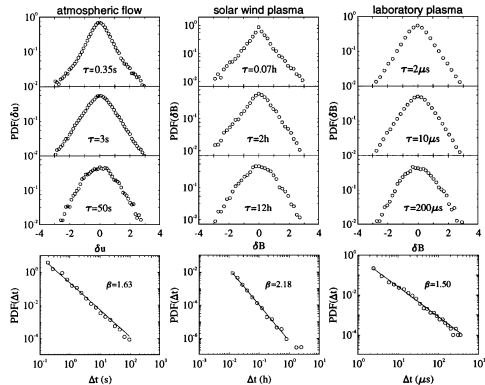
- The presence of **Intermittency**, as lack of self-similarity, revealed in laboratory plasmas, in analogy to solar wind turbulence and ordinary flow



EPL 54 p.51, PRL 87 p.045001, PPCF 2002 pp 2513, EPL 58, pp 349

Intermittency & SOC

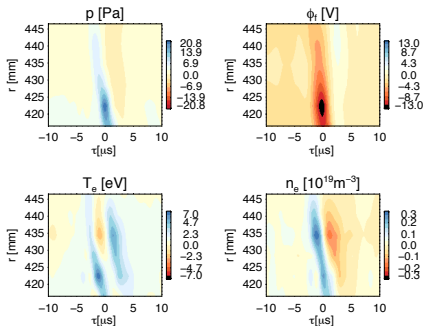
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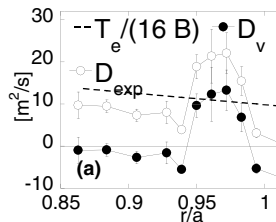
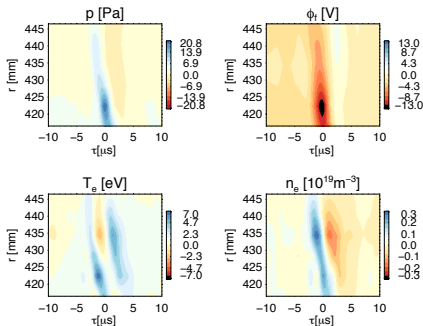
EPL 54 p.51, PRL 87 p.045001, PPCF 2002 pp 2513, EPL 58, pp 349

- ▶ Inconsistency with **SOC** model revealed PRL 86 pp 3032, EPL 58 pp 349, PRL 87 045001

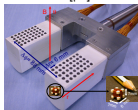
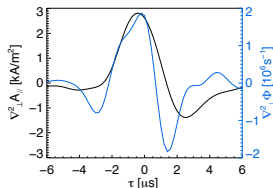
- Complete characterization of coherent structures responsible for intermittency



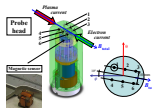
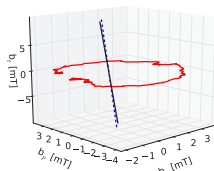
- Complete characterization of coherent structures responsible for intermittency
- Evaluation of transport contribution due to coherent structures



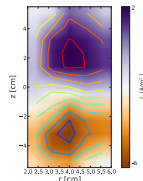
- Measurements of parallel plasma current associated to *blobs & filaments* in different experiments



RFX-mod Reversed Field Pinch



ASDEX-Upgrade Tokamak



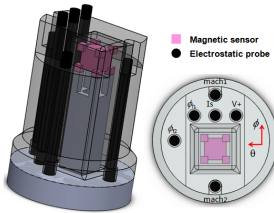
TORPEX SMP

- Parallel current measured for **Drift-Kinetic Alfvén vortices** in RFX-mod (PRL 102 p 165001, NF 50 p.042002), **type I ELMs filaments** in ASDEX-Upgrade (PRL 106 p 125002), **interchange-induced blobs** in TORPEX (CRPP) (PRL 106 p 245001)

- ▶ Collaboration established to extend studies of current filaments to other devices, namely TJ-II stellarator, with a probe which combines vorticity and current measurements and EAST tokamak for the studies of ELMs

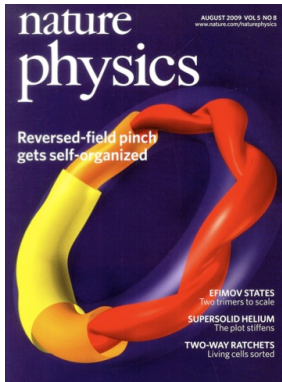


TJ-II Stellarator

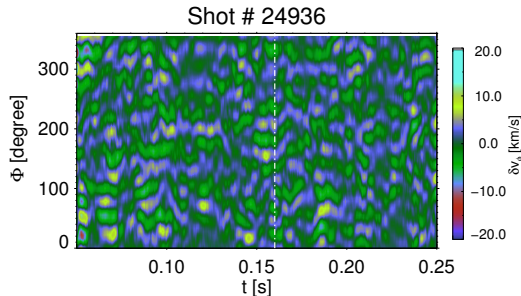


EAST-Tokamak

- ▶ Coordination of EFDA working group on 3D field effects in edge and SOL and diagnostic development under EFDA Transport Topical Group for 2011



- ▶ Observation and characterization of spontaneous helical plasmas developing in high current Reversed Field Pinch operation
Nat. Phys. 5 pp. 570



- ▶ Small residual helical ripple influence on edge physics
- ▶ Helical flow associated to dominant mode
- ▶ Relationship between magnetic topology and flow also in the framework of high density radiative collapse

Pedagogical experience

- ▶ Assistant for the course **Fluid and Plasma physics** with lessons on **Tangential stress in a newtonian fluid** and exercise on fluid dynamics
- ▶ Supervising of 2 Bachelor and 1 Ms.Sci. Thesis on Plasma physics. Addressed the following thematic:
 - (a) BA.: Modification of spectral properties of fluctuations as a function of plasma equilibria in a Reversed Field Pinch. Role on the emphasis of $m = 0$ islands
 - (b) BA: The role of toroidal flow in the high density regimes of an RFP plasma. Relation between flow and topology
 - (c) M.Sci: Comparison between filamentary structures in a Reversed Field Pinch and a Tokamak

Planned research activity

3D effects on flow and transport: 3D effects are present in almost all the present experiment and foreseen for future one. The role of 3D magnetic field on flow, both in the external region where stochastic layer can be created, and in the core are fundamental topic to be addressed and considered

Fast ions: MHD and turbulence modification of fast ion population is a subject to be investigated for future machines. Experimentally, small devices may be thought as test bed if equipped with tools for fast ion injections (Beam or ion sources), or if available spontaneous population (reconnecting processes)

Spontaneous magnetic reconnection: Interdisciplinary subject where collaboration with space and astrophysical plasma may be considered

Planned pedagogical activity

Multidisciplinary approach to data analysis: A lot of techniques, used in different research area (e.g. space plasma, signal and image processing, speech recognition etc.), may be applied to fusion plasma data

Small fusion device as learning tools: The use of smaller device, eventually with cold plasmas may offer the opportunity for students for a comprehensive approach to the data, from the diagnostic through the acquisition up to the analysis