

## Personal information

Name	Nicola Vianello
Date and Place of birth	14 August 1975, Venice, Italy
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## Education

1993	<b>High School Leaving Certificate</b> , Liceo Scientifico Statale <i>U.Morin</i> , Venice Italy. Grade: <b>56/60</b>
1999	<b>M. Sci. Physics</b> , <i>Università degli Studi di Padova</i> . Grade: <b>110/100 cum Laude</b>
Thesis Title	<i>Trasporto di particelle ed energia per effetto di turbolenza elettrostatica in plasmi confinati in configurazione Reversed Field Pinch (Particle and energy transport induced by electrostatic turbulence in Reversed Field Pinch plasmas)</i>
advisor	Prof. S. Lo Russo, Dr. V. Antoni
1999	<b>PhD in Energetics</b> , <i>Università degli Studi di Padova</i>
Thesis Title	<i>Self-organization phenomena and coherent structure generation</i>
advisor	Prof. A. Buffa, Dr. V. Antoni

## Schools

2000	<i>International School of Plasma Physics and Ultrafast Optics</i> , Capri, Italy
2001	<i>5<sup>th</sup> Carolus Magnus Euro-Summer School on Plasma and Fusion Energy Physics</i> , Badhonnef, Germany
2002	<i>International School on Topics in Nonlinear Dynamics</i> , Venice, Italy
2011	<i>5<sup>th</sup> International Iter Summer School: MHD and Energetic Particles</i> , Aix-en-Provence, France

## Employment

1999	<i>Consorzio RFX, Padova, Italy</i> , Research Fellow
2002–2003	<i>Consorzio RFX, Padova, Italy</i> , Research Fellow
2003–2009	<i>Consorzio RFX, Padova, Italy</i> , Research Scientist
2009–2015	<i>Consiglio Nazionale delle Ricerche</i> , Research permanent staff
2015–	<i>Swiss Plasma Center, Ecole Polytechnique Federale de Lausanne</i> , Scientist

## Experience

March – June 2001	Visiting scientist at Royal Institute of Technology, Stockholm, Sweden
May – June 2002	Visiting scientist at Royal Institute of Technology, Stockholm, Sweden
March – April 2003	Visiting scientist at Royal Institute of Technology, Stockholm, Sweden
April – June 2004	Visiting scientist at Royal Institute of Technology, Stockholm, Sweden
October-November 2005	Visiting scientist at Risø National Laboratory, Denmark

February 2008	Visiting Scientist at Max-Planck Institut für Plasmaphysik, Garching, Germany
May 2009	Visiting Scientist at Max-Planck Institut für Plasmaphysik, Garching, Germany
November 2009	Visiting Scientist at Centre der Recherches en Physique des Plasmas, EPFL, Lausanne
March 2011	Visiting scientist at Royal Institute of Technology, Stockholm, Sweden
April 2011	Visiting scientist at the National Fusion Laboratory, CIEMAT, Madrid
May 2011	Visiting Scientist at Max-Planck Institut für Plasmaphysik, Garching, Germany
February-March 2012	Visiting Scientist at Culham Centre for Fusion Energy, Oxford, JET
July-September 2013	Visiting Scientist at Culham Centre for Fusion Energy, Oxford, JET
May 2014	Visiting Scientist at Max-Planck Institut für Plasmaphysik, Garching, Germany
July 2014	Visiting Scientist at Culham Centre for Fusion Energy, Oxford, JET

## Invited Lectures

July 2012	Invited lecture at the <i>Workshop on Electric Field, Turbulence Self Organization in Magnetized Plasmas</i> , Stockholm, Sweden
Title	<i>The role of 3D fields on edge and SOL turbulence</i>
July 2012	Invited lecture at the <i>41<sup>st</sup> EPS Conference in Plasma Physics</i> , Berlin, Germany
Title	<i>Magnetic perturbation as a viable tool for edge turbulence modification</i>

## Competition and Habilitation

May 2009	Public selection (Ref.364/12) held by Consiglio Nazionale delle Ricerche, for research position
Advisor Committee	Prof. A. Fasoli, Ecole Polytechnique Federale de Lausanne, Switzerland Dr. V. Antoni, Consiglio Nazionale delle Ricerche, Istituto Gas Ionizzati, Padova Dr. D. Farina, Consiglio Nazionale delle Ricerche, Istituto di Fisica del Plasma, Milano
Result	The competition included written exams and oral colloquium. The candidate resulted the winner of the competition with a final mark of 104.5/120
2012	Abilitazione Scientifica Nazionale (ASN National Scientific Habilitation). Public evaluation of the competences and scientific achievements to obtain the qualification of <i>Professore Associato</i> (Associate Professor) in Experimental Physics and Material Science
Grade	Excellent

## IT skills

Operating systems	Linux, Unix, Mac OSX, Windows, Open VMS
Programming	IDL (Interactive Data Language), Python/NumPy/SciPy, GIT Version Control, Bash
Office	Microsoft Office, iWork, L <sup>A</sup> T <sub>E</sub> X, web, emails
Design	Adobe InDesign, Adobe Illustrator

## Technical Skills and Interest

Areas	Data analysis and Interpretation including advanced statistical tools for turbulent signals
Technicals	Competences in electrostatic and magnetic plasma diagnostic, competences in UHV technology, competences MDSplus technology for data acquisition

## Duties and Responsibilities

2007–2015	Responsible Scientist for edge manipulators in RFX-mod device. Responsibilities implies the maintenance and improvement of the two manipulators used in RFX-mod for the insertion of edge probes, including maintenance and improvement of the probe heads. Development of new complex probe head, project which has required the coordination between design, mechanical and diagnostic technicians.
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- 2009 Task force leader in RFX-mod experiment for task force *Particle, Momentum and energy transport*. The task force was in charge to implement experimental proposals aimed to the comprehension of physical mechanisms which regulate particle momentum and energy transport in RFX-mod. The task force leaders together with the Scientific Coordinators take part to the decision processes concerning the experimental program of the machine, deciding priorities and objectives
- 2010 Task force leader in RFX-mod experiment for task force *Physics integration for high performance RFP*. The task force aimed to coordinate all the efforts devoted to the comprehension of the physical mechanism behind the appearance of improved confinement regimes in RFX-mod, to establish the physical requirement for a controlled achievement of h-mode confinement regime and to explore all the still open basic physics issues whose knowledge could help to improve plasma performances. As in the previous year the task force leaders take part to the scientific program schedule, coordinating in particular the activities for the high current performance operations.
- 2011 Coordinator of the EFDA working group *3D field effects in edge and SOL and diagnostic development* under EFDA Transport Topical Group. This working group has been established to coordinate the effort promoted by different EFDA associations on the following subject:
1. Investigation on the effect of non-axisymmetric fields on the filamentary structures (L and H-mode regimes)
  2. Investigation into changes in edge transport due to the application of 3D fields
  3. Characterization of the edge turbulence in these 3D situations (including effect of ion temperature and 3D fast particle losses)
  4. Edge turbulence and transport modelling by incorporating 3D field effects into the codes.
  5. Comparison studies between tokamaks, stellarators and RFPs on the above topics.
- The coordinators promote exchange of results between different association and the definition of common objectives which facilitate the comparison between different devices.
- 2012 Member of the Program committee of the 17th Joint EU-US Transport Task Force Meeting in combination with the 4th EFDA Transport Topical Group meeting, 3-6 September 2012, Padova, Italy
- 2013 Scientific Coordinator of back-up experiment *B13-19 Investigation of M-Mode* on JET campaigns C31-C34. This implies the coordination of the experimental activity in order to investigate the so called *M-Mode*, a particular state of the plasma characterized by a medium grade confinement accompanied by the appearance of an alfvénic like oscillations. Coordination means assigning activities to the experimental team, plan the possible experimental campaign to be designed in collaboration with Session leaders, establish scientific objectives and monitoring scientific activities.
- 2014 Scientific Coordinator of experiment *AUG14-2.2-3, SOL filamentary transport at high density*, under the MST1 Eurofusion Work-Packages
- 2015 Scientific Coordinator of experiment *TCV15-2.2-3: Filamentary Transport in the SOL* under MST1 Eurofusion Work-Package
- 2015 Scientific Coordinator of experiment *TCV15-1.5-1, Mitigation of high Z impurity accumulation through combined central ECRH and tailoring of MHD activity in high performance H-modes* under MST1 Eurofusion Work-Package

## Teaching

2008–2009	Assistant for the course <i>Fluid and Plasma Physics</i> , Department of Physics, University of Padova
2010	Assistant for the course <i>Fluid and Plasma Physics</i> , Department of Physics, University of Padova
2011–2012	Assistant to the course <i>Fundamental of Plasma Physics</i> , Department of Physics, University of Padova
2012–2013	Assistant to the course <i>Fundamental of Plasma Physics</i> , Department of Physics, University of Padova

2013-2014	Assistant to the course <i>Fundamental of Plasma Physics</i> , Department of Physics, University of Padova
2013-2014	Lecturer for basic Physics course of the Joint Research Doctorate and European Interuniversity Doctoral Network on Fusion Science and Engineering
2014-2015	Assistant to the course <i>Fundamental of Plasma Physics</i> , Department of Physics, University of Padova

## Supervising

2007	Supervisor for Bachelor Thesis, Department of Physics, University of Padova, candidate: A. Scaggion
2009	Supervisor for M.Sci. Thesis, Department of Physics, University of Padova, candidate: A. Scaggion
2011	Supervisor for Bachelor Thesis, Department of Physics, University of Padova, candidate: A. Mazzi
2013	Supervisor for M.Sci. Thesis, Department of Physics, University of Padova, candidate: A. Mazzi
2015	Supervisor for PhD. Thesis, Department of Physics, University of Padova, candidate: C. Rea

## Research Interest

I've been involved in fusion plasma science since my M.Sci. thesis in Physics in 1999. During these 16 years I've tried to expand as much as possible my personal research skills focusing in particular on collection, analysis, interpretation and modeling of experimental data collected in fusion oriented experiments (Reversed Field Pinches, Tokamaks and Stellarators), with particular emphasis on the comparison with theoretical and numerical results. Main research subjects may be summarized as follow:

- (a) **Electromagnetic turbulence induced transport:**, with emphasis on anomalous transport studies induced by different source of turbulence: electrostatic as Drift-induced or interchange induced transport, or electromagnetic including the role of magnetic flutter fluxes in the mechanism of particle and energy losses
- (b) **Statistical analysis of plasma turbulence:** the topic allowed me to get confident with advanced statistical tool (as Wavelet Transforms, Local Intermittency Measurements, Waiting Time distribution) and with dynamical system model as Self-Organized Criticality (SOC) systems, shell-models
- (c) **Blobs and ELM filaments:** non linear coherent structures arising as a non-linear evolution of plasma instabilities have been experimentally investigated. The research includes studies on the generation and evolution of these structures including their parallel dynamics with emphasis on turbulent *blobs* and ELM *filaments*
- (d) **Sheared flow generation** and non linear interaction between turbulence and sheared flows including experimental investigation of the role of Maxwell and Reynolds stress in the momentum generation of edge flow in Reversed Field Pinches
- (e) **Numerical modeling of electromagnetic plasma turbulence** using fluid approach
- (f) **Magnetic topology and its relation with plasma flow**, with emphasis on the effect of non-axisymmetric magnetic field perturbation on kinetic properties of the plasma, as plasma flow, ambipolar electric field and Plasma Wall Interaction
- (g) **Beam plasma interaction** with emphasis on Alfvén instabilities, Energetic Particle Driven instabilities, and turbulent transport of energetic ions

Among the results the following should be highlighted:

- (i) First experimental proof of non applicability of *Self Organized Criticality* paradigm to edge plasma turbulence [A2, A1]
- (ii) First experimental evidence of non-linear generation of edge flow in Reversed Field Pinches through Reynolds stress mechanism [A4, A3]
- (iii) First experimental measurements of parallel current associated to coherent structures in a fusion relevant plasma [A6]

- (iv) First experimental evidence of the existence of a particular class of coherent structure, named *Drift-Kinetic Alfvén vortices*, arising because of the non linear coupling of Drift and Kinetic Alfvén waves in a laboratory plasma [A7]. This type of structure has been previously detected in the magnetosphere
- (v) First experimental estimate of parallel current associated to Edge Localized Modes filament [A9]
- (vi) First experimental measurements of 2D current distribution associated to plasma blobs [A8]
- (vii) Experimental evidence of transition towards helical states in high current Reversed Field Pinch operation [A5]

In all my carrier I've always tried to conjugate a strong experimental insight on the data collection, participating in all the experimental activities mandatory in order to obtain useful experimental results, and a rigorous theoretical approach in the data analysis and interpretation, using theories and numerical tools as a framework to understand real plasma signals. This approach helped me to build a bridge between theories and experiments, a necessary effort in order to understand complex plasma dynamics.

## Cited publications

- [A1] V. Antoni, V. Carbone, R. Cavazzana, G. Regnoli, N. Vianello, E. Spada, L. Fattorini, E. Martines, G. Serianni, M. Spolaore, L. Tramontin, and P. Veltri "Transport processes in reversed-field-pinch plasmas: Inconsistency with the self-organized-criticality paradigm", *Phys. Rev. Lett.* **87**, 045001, (2001).
- [A2] E. Spada, V. Carbone, R. Cavazzana, L. Fattorini, G. Regnoli, N. Vianello, V. Antoni, E. Martines, G. Serianni, M. Spolaore, and L. Tramontin "Search of self-organized criticality processes in magnetically confined plasmas: Hints from the reversed field pinch configuration", *Phys. Rev. Lett.* **86**, 3032–3035, (2001).
- [A3] N. Vianello, V. Antoni, E. Spada, M. Spolaore, G. Serianni, R. Cavazzana, H. Bergsaker, M. Cecconello, and J. Drake "Reynolds and Maxwell stress measurements in the reversed field pinch experiment Extrap-T2R", *Nucl. Fusion* **45**, 761–766, (2005).
- [A4] N. Vianello, E. Spada, V. Antoni, M. Spolaore, G. Serianni, G. Regnoli, R. Cavazzana, H. Bergsaker, and J. R. Drake "Self-Regulation of ExB Flow Shear via Plasma Turbulence", *Phys. Rev. Lett.* **94**, 135001, (2005).
- [A5] R. Lorenzini, E. Martines, P. Piovesan, D. Terranova, P. Zanca, M. Zuin, A. Alfier, D. Bonfiglio, F. Bonomo, A. Canton, S. Cappello, L. Carraro, R. Cavazzana, D. Escande, A. Fassina, P. Franz, M. Gobbin, P. Innocente, L. Marrelli, R. Pasqualotto, M. Puiatti, M. Spolaore, M. Valisa, N. Vianello, and P. Martin "Self-organized helical equilibria as a new paradigm for ohmically heated fusion plasmas", *Nat Phys* **5**, 570–754, (2009).
- [A6] M. Spolaore, N. Vianello, M. Agostini, R. Cavazzana, E. Martines, P. Scarin, G. Serianni, E. Spada, M. Zuin, and V. Antoni "Direct Measurement of Current Filament Structures in a Magnetic-Confinement Fusion Device", *Phys. Rev. Lett.* **102**, 165001, (2009).
- [A7] N. Vianello, M. Spolaore, E. Martines, R. Cavazzana, G. Serianni, M. Zuin, E. Spada, and V. Antoni "Drift-Alfvén vortex structures in the edge region of a fusion relevant plasma", *Nuclear Fusion* **50**, 042002, (2010).
- [A8] I. Furno, M. Spolaore, C. Theiler, N. Vianello, R. Cavazzana, and A. Fasoli "Direct Two-Dimensional Measurements of the Field-Aligned Current Associated with Plasma Blobs", *Physical Review Letters* **106**, 245001, (June 2011).
- [A9] N. Vianello, V. Naulin, R. Schrittwieser, H. W. Müller, M. Zuin, C. Ionita, J. J. Rasmussen, F. Mehlmann, V. Rohde, R. Cavazzana, and M. Maraschek "Direct Observation of Current in Type-I Edge-Localized-Mode Filaments on the ASDEX Upgrade Tokamak", *Physical Review Letters* **106**, 125002, (2011).

## Publications

I've authored a total number of **99 Articles** in peer reviewed journal, **87 Conference proceedings** and personally presented **18 oral contributions**. The complete list of publications is available as a separate file.  
h-index factor: **21** according to ISI Web of Knowledge (last update October 26, 2015)

## Referees

Name	Prof. Volker Naulin
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Institute Dipartimento di Ingegneria Industriale, Università degli Studi di Padova e Consorzio RFX  
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Name Dr. Dominique Escande  
Institute Aix-Marseille Université, CNRS, PIIM, UMR 7345  
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## Other

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I'm regular referee for Physical Review Letters, Plasma Physics and Controlled Fusion, Nuclear Fusion.

## Declaration

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I hereby declare that the above information are true and correct to the best of my knowledge and belief and in the event of any information being found false or incorrect, my candidature will be liable to be canceled.

Lausanne, October 26, 2015



(Nicola Vianello)