Francesco (Franco) Porcelli

Full Professor, Physics of Matter, Polytechnic University of Turin, Italy
Born in Palermo, 18 November 1959. Italian citizen.
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Concise Curriculum Vitae

PERSONAL INFORMATION

Name	PORCELLI, FRANCESCO
Address	VIA DELLE SCUOLE 10, 28043 BELLINZAGO NOVARESE (NO), ITALY
Telephone	+39 333 8444346
Electronic mail	francesco.porcelli@polito.it
Nationality	Italian
Date of birth	18 NOVEMBER 1959

UNIVERSITY EDUCATION AND TRAINING

Dates	1 January 1983 – 30 June 1987
University	Scuola Normale Superiore di Pisa, Italy
Field	Physics
Degree	Dottorato di Ricerca (PhD), with a PhD thesis entitled *Magnetic Reconnection and Plasma Collective Modes* (advisor: Bruno Coppi, MIT).

Dates	1 September 1983 – 30 September 1985
Affiliation	Massachusetts Institute of Technology, Cambridge, MA, USA
Position	Visiting PhD student (followed by post-doctoral appointment at MIT, until 30 September 1987)
Role	Research in the theory of magnetically confined plasmas, under B. Coppi's supervision).

Dates	1 October 1978 – 17 November 1982
University	Università degli Studi di Torino
Field	Physics
Degree	*Laurea* in Physics, with a Thesis entitled Waves and Instabilities in Magnetically confined plasmas (advisor: Francesco Pegoraro, Scuola Normale, Pisa).

WORK EXPERIENCE

Dates	Since 1 October 2005
Affiliation	Politecnico di Torino, Italy; Department of Applied Science and Engineering
Position	Full Professor
Scientific sector	Physics of Matter (FIS/03) – Theoretical Plasma Physics

Dates	1 July 2007 – 30 June 2015
Affiliation	Embassy of Italy in Egypt, Italian Ministry of Foreign Affairs (on Politecnico university leave)
Position	Scientific Attaché
Main responsibilities	Director of the Scientific Office; facilitate Egyptian-Italian cooperation in Science and Technology

Dates	1 January 1994 – 30 September 2005
Affiliation	Politecnico di Torino, Italy; Department of Energetics
Position	Associate Professor
Scientific Sector	Physics of Nuclear Reactors (ING-IND/18) – Fusion Reactor Physics

Dates	1 April 1989 – 31 December 1993
Affiliation	JET Joint Undertaking, Abingdon, UK; Analytic Theory Group
Position	EURATOM staff member
Main responsibilities	Theory and interpretation of tokamak fusion plasma experiments

Dates	1 October 1987 – 31 March 1989
Affiliation	JET Joint Undertaking, Abingdon, UK; Analytic Theory Group
Position	EURATOM post-doctoral fellow
Main responsibilities	Theory and interpretation of tokamak fusion plasma experiments

Dates	1 October 1985 - 30 September 1987
Affiliation	Massachusetts Institute of Technology, Cambridge, MA, USA; Research Laboratory of Electronics
Position	Post-doctoral associate
Main responsibilities	Theory of instabilities and collective modes in magnetically confined plasmas.

MANAGERIAL EXPERIENCE

Dates	Since 2016
Affiliation and partnership	Politecnico di Torino, Italy, in partnership with the Egyptian Ministry of Antiquities
Role	Mission Director; project *Luxor Valley of the Kings*.
Main Responsibilities	Coordinate the activities for the search of hidden chambers and underground void areas of archeological significance in Luxor Valle of the Kings (Egypt) using state-of-the-art geophysical equipment; project fund raising and budget administration; coordinate contacts between Ministry officials, scientists and sponsors; official (Politecnico di Torino) spokesperson and media contact for the project.

Dates	1 July 2007 – 30 June 2015
Affiliation	Embassy of Italy in Egypt, Italian Ministry of Foreign Affairs
Role	Scientific Attaché and Director of the Scientific Office
Main responsibilities	Manage the Scientific Office at the Embassy of Italy in Egypt (including technical, administrative and secretarial staff and young trainees); Advice the Italian Ambassador in Egypt on opportunities for Egyptian-Italian bilateral cooperation; Interface between Egyptian and Italian governments for the organization of official visits and bilateral summits; Administer a budget for the organization of scientific events and missions.

Dates	2002 - 2012
Affiliation	Leader of the *Burning Plasma Research Group* at the Politecnico di Torino, Italy
Role	Group Leader. The group involved post-doctoral fellows, a CNR staff member, PhD students and several international long-term visiting scientists, with a peak of eight full time members in the period 2003-2004.
Main Responsibilities	Coordinate and stimulate research activities; fund raising and budget administration; International cooperation and liaising with the European Fusion Program, ENEA fusion department, CNR fusion and plasma physics institutes, Italian and international universities and research centers active in plasma physics.

Dates	2005 - 2007
Affiliation and Partnership	Politecnico di Torino, in partnership with the European Fusion Development Agreement (EFDA)
Role	Leader of the *Nonlinear MHD Integrated Modeling Task Force*.
Main responsibilities	Coordinate European research activities in the area of nonlinear MHD modeling of fusion tokamak plasmas.

Dates	2004 - 2005
Affiliation	Politecnico di Torino, Italy
Role	Elected member (representative of Associate Professors) of the Academic Senate
Main responsibilities	Participate in decision-making as member of the main governance body of the Politecnico di Torino

Dates	2003 - 2004
Affiliation	Politecnico di Torino, Italy
Role	Elected member (representative of Associate Professors) of the Executive Board of the Department of Energetics
Main responsibilities	Participate in decision-making as member of the Department main governance body.

Dates	1998-1999
Affiliation and Partnership	Politecnico di Torino, in partnership with the National Research Council of Italy (CNR)
Role	National Coordinator, project *Turbulence and Nonlinear Phenomena in Plasmas.*
Main responsibilities	Coordinate project research activities and budget administration; the project involved eight university research groups and two CNR institutes (IPP Milan and IGI Padova).

LONG TERM VISITING POSITIONS

Dates	Autumn 2016 and Autumn 2017 (six months in total)
Affiliation	University of Science and Technology of China (USTC), Hefei, China
Role	International Visiting Professor
Main Responsibilities	Establish and start-up a course on the Theory of Tokamak Fusion Plasmas; advice USTC PhD students; research on the MHD theory of fusion plasmas.

Dates	1 September 2000 – 31 August 2001
Affiliation	Plasma Science and Fusion Center, MIT, Cambridge, MA, USA
Role	Visiting Professor, on sabbatical from the Politecnico di Torino and seconded by the ENEA/EURATOM Association.
Main Responsibilities	Research on the Physics of tokamak fusion plasmas; Taught a PhD course on Magnetic Reconnection in Plasmas

Dates	1998 – 1999 (nine months in total)
Affiliation	CRPP, École Polytechnique Fédérale de Lausanne, Switzerland
Role	Visiting Professor
Main Responsibilities	Research on the Physics of tokamak fusion plasmas.

Dates	1995 – 1997 (eight months in total)
Affiliation	ITER Physics Integration Unit, San Diego, CA, USA
Role	Visiting Professor, seconded by the ENEA/EURATOM Association.
Main Responsibilities	Assessment of the relevant Physics issues of projected ITER plasma (International Tokamak Experimental Reactor)

Dates	1990 – 1997 (yearly visits, typically 1-3 month per year)
Affiliation	Institute for Fusion Studies (IFS), University of Texas at Austin, TX, USA
Role	Visiting Professor
Main Responsibilities	Research on the Physics of tokamak fusion plasmas.

Dates and affiliation	1994 – 2007, frequent visits, JET Joint Undertaking, Abingdon, UK.
Dates and affiliation	2000 – 2005, frequent visits (eight months in total), Département de Recherches sur la Fusion Contrôlée, C.E.A., Cadarache, France.
Dates and affiliation	July-August 2004, Los Alamos National Laboratory, NM, USA.
Dates and affiliation	August 1999, Kurchatov Institute, Moscow, Russia.

CNR ASSOCIATIONS

Dates	1998 - 2002
Association	CNR-IFP Associate Member, Istituto di Fisica dei Plasmi, Milano.
Dates	2016 - 2018
Association	CNR-ISMA Associate Member, Istituto di Studi sul Mediterraneo Antico, Roma.

OTHER PROFESSIONAL ASSIGNMENTS

Dates	2012-2015
Task	Italian Delegate (Ministry of Foreign Affairs) to the SESAME Council in Amman, Jordan (SESAME = Synchrotron-light Experimental Science and Applications in the Middle East).
Dates	2002-2020
Task	Co-Editor for Fluids and Plasmas of the International Journal *Physics Letters A.*
Dates	2000-2011
Task	Consultant for the US Department of Energy (while on sabbatical at MIT).
Dates	1999-2000
Task	Member of the Thermonuclear Tokamak Panel, established by the late French C.E.A. High Commissioner Prof. R. Pellat, to assess the relevant physics issues for the IGNITOR and ITER tokamak fusion experiments.

PERSONAL SKILLS

MOTHER TONGUE **ITALIAN**

OTHER LANGUAGES

	ENGLISH	**FRENCH**	**ARABIC**
Understanding	EXCELLENT	GOOD	BASIC
Speaking	EXCELLENT	BASIC	BASIC
Writing	EXCELLENT	BASIC	BASIC

COMMUNICATION AND DIPLOMATIC SKILLS

Excellent relational and diplomatic skills, acquired during years of collaboration with international research groups and more recently as Science Advisor at the Embassy of Italy in Egypt. Excellent at motivating team work and at finding ways to valorize individual skills and synergyes among individual team members.

ORGANIZATIONAL/MANAGERIAL SKILLS

Proven experience with fund raising, budget administration, team and capacity building, development of strategic vision. Hard working, reliable and highly motivated. Excellent at working with students, believe in the importance of training a new generation of young fusion and plasma scientists.

ADDITIONAL INFORMATION

Author of more than 120 publication on international peer reviewed journals, more than 130 invited and contributed presentation in international conferences and research institutions, advisor to several PhD research theses.

Annex
Francesco (Franco) Porcelli
CV – Details and additional information

I. Research activity

Franco Porcelli is a Full Professor of Plasma Physics and the Physics of Matter at the Polytechnic University of Turin, Italy. A former student of Bruno Coppi at MIT and of Francesco Pegoraro (Scuola Normale Superiore and University of Pisa), he was a member of the Analytic Theory group at JET (1987-1993), a member of the ITER Physics Integration Group (1994-1996) and he still is a member of EUROFusion (former leader of the European Nonlinear MHD tokamak modeling task force). On sabbatical at MIT-PSFC in 2000-2001. In 1999-2000, he was a member of the Panel set up by the late René Pellat, former Director of CEA France, to investigate physics issues relevant to the next generation of tokamak experiments, with particular reference to the IGNITOR and ITER projects [1,2]. Franco Porcelli is an expert on resistive and kinetic MHD and is best known for the development of a model for the sawtooth period and amplitude [3] (in collaboration with Marshall Rosenbluth), for the theoretical interpretation of fishbones [4] and fast particle stabilization of MHD modes [5, 6] and for his work on magnetic reconnection [7-13]. Other research interests include astrophysical plasmas (see, e.g., Refs. [14,15]) and the industrial applications of thermal plasmas (see, e.g., Ref. [16]).

At the beginning of his career, while at MIT (1983-1987), he developed a theoretical model for *fishbone oscillations* in beam injected plasmas [4], in collaboration with Prof. Bruno Coppi.

At JET, he worked in close collaboration with Francesco Pegoraro and with JET experimentalists, providing theoretical support for the interpretation of JET experiments. During this period, his most important achievement was the development of the model for fast particle stabilization of *sawtooth oscillations*, providing an explanation for the so-called *monster sawteeth* first observed at JET [5,6]. He further refined the theory to provide the basis for kinetic-MHD modeling of tokamak plasmas, in collaboration with Prof. Herb Berk and co-workers from the Institute for Fusion Studies, U. of Texas at Austin [17,18]. He was among the first researchers to identify the importance of collisionless regimes for the occurrence of sawtooth oscillations in the JET experiments [8], which led to the development of the first nonlinear model for fast magnetic reconnection in collisionless plasmas [9].

After he moved to the Polytechnic University of Turin in 1994, Franco Porcelli continued to be an active member of the European Fusion Community. Immediately after his arrival in Turin, he joined efforts with fusion engineers in Turin, so that the Polytechnic University of Turin became an associated center of the ENEA/EURATOM Association.

In 1995-1997, Franco Porcelli was seconded, through the ENEA/EURATOM Association, to the ITER Physics Integration Unit in San Diego, as European Home Team Personnel. He spent a total of eight months at the ITER Joint Work Site. His most important achievement during this period was the formulation of a model for the sawtooth period and amplitude, in collaboration with Dominique Boucher and Marshal Rosenbluth. This model is still used today as the standard model for predicting the behavior of sawtooth oscillations and the possible occurrence of monster sawteeth in projected ITER plasmas [3]. In collaboration with M. Rosenbluth, he also developed the modified Mercier criterion for interchange modes in tokamaks in the presence of high-energy particles [19].

In 1998-1999, Franco Porcelli collaborated with the TCV group at CRPP Lausanne. There, he developed a model for the so-called *humpback sawtooth oscillations* [20]. He also developed a theory for the occurrence of multi-peaked electron temperature profiles during ECRH plasma heating [21].

In 1999-2000, Franco Porcelli was a member of the Thermonuclear Tokamak Panel, convened by the late Prof. R. Pellat, CEA High Commissioner. The task assigned to the Panel was a comparative study of predicted ITER and IGNITOR fusion performance [1,2].

In 2000-2001, Franco Porcelli spent a sabbatical year at the MIT Plasma Science and Fusion Center. There, he developed a theory for magnetic reconnection phenomena in X-point configurations, in support of observations on the MIT VTF experiment [22]. He also developed a model for spontaneous toroidal rotation observed in ALCATOR C-MOD during ICRH heating, in collaboration with Lars- Goran Eriksson [23].

In 2002, Franco Porcelli established the Burning Plasma Research Group at the Department of Energetics of the Politecnico di Torino (now Department of Energy), with financial support from the Italian National Institute for the Physics of Matter (INFM), the Ministry of Education and Research (MIUR) and the ENEA-EURATOM association. The group enjoyed the collaboration of research scientists, post-docs and PhD students from the Politecnico di Torino, as well as the presence in Turin of several well-known and long-term visiting plasma physicists. The Group was involved mainly in the development of the theory on collisionless magnetic reconnection in nonlinear plasma regimes, while providing theoretical support for the interpretation of several plasma experiments, such as JET, TORE- SUPRA, FTU, RFX, and for the prediction of ITER plasmas.

In the years 2001-2005, Franco Porcelli paid frequent visit to the CEA fusion group in Cadarache. In collaboration with Cadarache scientist Maurizio Ottaviani, he developed a model for nonlinear diamagnetic effects on neoclassical tearing modes [12].

In the years 2005-2007, Franco Porcelli was nominated Leader of the Nonlinear MHD Group within the EFDA Integrated Tokamak Modeling Task Force.

In 2008, Franco Porcelli and co-workers proposed a possible model for the occurrence of Quasi-Single-Helicity states in Reversed Field Pinch experiments [24], with particular attention to the RFX experiment in Padua operated by scientists of the CNR-IGI institute.

Since 2015, after returning to the Politecnico di Torino from a period of leave during which he served as Scientific Attaché at the Embassy of Italy in Egypt (2007-2015), Franco Porcelli started a new line of research in the field of Technologies applied to Cultural Heritage, with specific interest in Archaeo-Physics and Egyptological research. At present, he is the Coordinator of an International Project entitled “The Complete Geophysical Survey of the Valley of the Kings” [25-28].

In 2015, in the field of Technologies Applied to Cultural Heritage, he was a member of the team who established the meteoritic origin of Tutankhamen’s iron dagger blade [29].

In parallel with his new interest in Archaeo-Physics, Franco Porcelli continued to be an active member of the international fusion community. In 2016-2018, he started collaboration with the EAST tokamak (Institute of Plasma Physics of the Chinese Academy of Science) and with the University of Science and Technology, both in Hefei, China, where he was appointed International Visiting Professor. During this period, he co-authored with a junior scientist from Hefei an article on visco-resistive simulations of nonlinear internal kink modes in tokamak plasmas [30] and he contributed to the Physics basis of the Chinese Fusion Experimental Tokamak Reactor (CFETR).

In January 2017, he initiated research activity within the framework of a EUROFusion Enabling Research Project entitled "Understanding the role of reconnection in filament separation and its impact on plasma exhaust in tokamaks", coordinated by Stanislav Pamela, Culham CCFE, UK. Within the framework of this project, Franco Porcelli developed a new line of research on Resistive Axisymmetric X-Point modes, which appear to be relevant to the dynamics and operation of tokamak plasmas with divertor configurations [31-32].

In 2019, he started collaboration with the Institute for Fusion Theory and Simulations (IFTS) of the University of Zhejiang in Hangzhou, China, on aspect of sawtooth relaxation theory in tokamak plasmas [33], and with the Southwestern Institute of Plasmas (SWIP) in Chengdu, China, on aspect related to the theory of fishbone oscillations in tokamak plasmas [34].

II. Cited References

1. J. D. Callen, G. Cordey, O. Gruber, W. Horton, J. Jacquinot, G. Laval, J.-F. Luciani and F. Porcelli, **Thermonuclear Tokamak Panel Report**, presented to the C.E.A. High Commissioner René Pellat, 2000.

2. W. Horton, F. Porcelli, P. Zhu, A. Aydemir, Y. Kishimoto, T. Tajima, **Ignitor Physics Assessment and Confinement Predictions**, Nuclear Fusion **42**, Issue 2, Febbraio 2002.

3. F. Porcelli, D. Boucher and M. N. Rosenbluth, **Model for the sawtooth period and amplitude**, Plasma Physics and Controlled Fusion **38**, pp. 2163-2186 (1996).

4. B. Coppi and F. Porcelli, **Theoretical model of fishbone oscillations in magnetically confined plasmas**, Physical Review Letters **57**, p. 2272 (1986).

5. F. Porcelli, **Fast particle stabilisation**, Plasma Physics and Controlled Fusion **33**, pp. 1601-1621 (1991).

6. B. Coppi, P. Detragiache, S. Migliuolo, F. Pegoraro and F. Porcelli, **Quiescent window for global plasma modes**, Physical Review Letters **63**, pp. 2733-2736 (1989).

7. F. Porcelli, **Viscous resistive magnetic reconnection**, The Physics of Fluids 30, pp. 1734-1742 (1987).

8. F. Porcelli, **Collisionless m=1 tearing mode**, Physical Review Letters 66, pp. 425-428 (1991).

9. M. Ottaviani and F. Porcelli, **Nonlinear collisionless magnetic reconnection**, Physical Review Letters **71**, p. 3802-3805 (1993).

10. E. Cafaro, D. Grasso, F. Pegoraro, F. Porcelli and A. Saluzzi, **Invariants and geometric structures in nonlinear Hamiltonian magnetic reconnection**, Physical Review Letters **80**, 4430- 4433 (1998).

11. D. Grasso, F. Califano, F. Pegoraro and F. Porcelli, **Phase mixing and island saturation in Hamiltonian reconnection**, Physical Review Letters, 86, pp. 5051-5054 (2001).

12. M. Ottaviani, F. Porcelli and D. Grasso, **Multiple states of nonlinear drift-tearing islands**, Physical Review Letters 93, pp. 075001-1-4 (2004).

13. R. J. Hastie, F. Militello and F. Porcelli, **Nonlinear saturation of tearing mode islands,** Physical Review Letters, Vol. 95, issue 6, p. 65001 (2005).

14. F. Pegoraro and F. Porcelli, **Equation of state for relativistic plasma waves**, Physics of Fluids **27**, pp. 1665-1670 (1984).

15. P. G. Watson and F. Porcelli, **Exact steady-state reconnection solutions in weakly collisional plasmas,** Astrophysical Journal, Vol. **617**, p. 1353 (2004).

16. V. Baritello, F. Porcelli and F. Subba, **Plasma-Wall Boundary Layers**, Physical Review E **60**, pp. 4733-4742 (1999).

17. F. Porcelli, R. Stankiewicz, W. Kerner and H. L. Berk, **Solution of the drift-kinetic equation for global plasma modes and finite particle orbit widths**, Physics of Plasmas **1**, pp. 470-480 (1994).

18. F. Porcelli, R. Stankiewicz, H. L. Berk and Y. Z. Zhang, **Internal kink mode stabilization by high energy ions with nonstandard orbits**, The Physics of Fluids **B4**, pp. 3017-3023 (1992).

19. F. Porcelli and M. N. Rosenbluth, **Modified Mercier criterion**, Plasma Physics and Controlled Fusion **40**, 481-492 (1998).

20. F. Porcelli, C. Angioni, R. Behn, I. Furno, T. Goodman, M. A. Henderson, Z. A. Pietrzyk, A. Pochelon, H. Reimerdes, E. Rossi, O. Sauter, **Model for humpback relaxation oscillations**, Nuclear Fusion **40**, 1691 (2000).

21. F. Porcelli, E. Rossi, G. Cima and A. Wootton, **Macroscopic magnetic islands and plasma energy transport**, Physical Review Letters **82**, pp. 1458-1461 (1999).

22. J. J. Ramos, F. Porcelli and R. Verastegui, **Driven reconnection about a magnetic X-line with strong guide component**, Physical Review Letters **89**, 055002 (2002).

23. L.-G. Eriksson and F. Porcelli, **Dynamics of energetic ion orbits in magnetically confined plasmas**, Review Article, Plasma Phys. Control. Fusion **43**, R145-182 (2001); L.-G. Eriksson and F. Porcelli, **Toroidal Plasma Rotation Induced by Fast Ions Without External Momentum Injection in Tokamaks**, Nuclear Fusion **42** No 8 (2002) 959-971.

24. E. Tassi, F. Militello, F. Porcelli and R.J. Hastie, **Saturation of tearing modes in Reversed Field Pinches with locally linear force-free magnetic fields and its application to Quasi-Single- Helicity states**, The Physics of Plasmas, Vol. 15 (2008).

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27. F. Porcelli, G. Catanzariti, Filippo Barsuglia, Federico Fishanger, Gianfranco Morelli, Luigi Sambuelli, Cesare Comina, Giuseppina Capriotti and Ahmed Ellaithy, **La mappatura geofisica completa della Valle dei Re: Risultati del primo anno di attività (2016-2017)**, in VII volume della serie RISE - Ricerche Italiane e Scavi in Egitto - MAECI e Istituto Italiano di Cultura, Il Cairo (ISBN 978-88-908752-4-3).

28. F. Porcelli et al, **Integrated Geophysics and Geomatics Surveys in the Valley of the Kings**, Sensors **20**, 1552 (2020); doi:10.3390/s20061552.

29. D. Comelli, M. D'Orazio, L. Folco, Mahmud El-Halwagy, T. Frizzi, R. Alberti, V. Capogrosso, Abdelrazek Elnaggar, Hala Hassan, A. Nevin, F. Porcelli, Mohamed Gamal Rashed, G. Valentini, **The meteoritic origin of Tutankhamun's iron dagger blade,** Meteoritics and Planetary Science **51** (2016) 1301-1309.

30. Wei Shen and F. Porcelli, **Linear and nonlinear simulations of the visco-resistive internal kink mode using the M3D code**, Nucl. Fusion **58** 106035 (2018).

31. F. Porcelli and Adil Yolbarsop, **Analytic equilibrium of "straight tokamak" plasma bounded by a**

magnetic separatrix, Physics of Plasmas **26**, 054501 (2019), https://doi.org/10.1063/1.5096838.

32. Franco Porcelli, A. Yolbarsop, T. Barberis, R. Fitzpatrick, **Resonant Axisymmetric Modes**, to appear in Journal of Physics Conference Series, 2021.

33. W. Zhang, Z. W. Ma, F. Porcelli, H. W. Zhang and X. Wang, **Sawtooth relaxation oscillations, nonlinear helical flows and steady-state m/n=1 magnetic islands in low-viscosity tokamak plasma simulations**, Nuclear Fusion 60, 096013, 2020.

34. Y. Miao, G. Hao, M. Hole, Franco Porcelli et al, **Fishbone instability driven by trapped fast ions in a toroidal plasma with reversed magnetic shear**, Nuclear Fusion 60, 096022, 2020.

III. Main Research Grants

1998-1999: National Coordinator of a CNR special project, entitled: *Topological transitions, Transizioni topologiche,turbulence and nonlinear phenomena in plasmas.* The projects involved eight Italian university groups and two institutes of the National Research Council (CNR) of Italy, namely, IFP Milan and the RFX Consortium of Padua.

2000-2006: Grant by the Research Program of National Interest (PRIN) of the Italian Ministry of Education, University and Research, for the investigation of the behavior of plasmas close to thermonuclear ignition conditions.

1995-2007 Grant by ENEA/Euratom Association for research activities in the area of the Physics of Tokamak plasmas.

2000-2007 Grant by the National Institute for the Physics of Matter (INFM), for the numerical modeling of basic plasma physics phenomena.

2017-2018 Grant by EUROFusion for participation to the Enabling Research project "Understanding the role of reconnection in filament separation and its impact on plasma exhaust in tokamaks", coordinated by Stanislav Pamela, Culham CCFE, UK.

2016-2018 Grant by the Polytechnic University of Turin for participation in the project “Luxor Valle dei Re: The Complete Geophysical Survey of the Valley of the Kings”, co-sponsored by the Fondazione Novara Sviluppo and by National Geographic Explorer Program.

2018-present National Geographic Explorer Grant for Archaeo-Physics research at Valley of the Kings, Luxor, Egypt.

IV. Teaching Activity

Courses taught:

- **The Principles of Tokamak Fusion Plasmas**, for Master and PhD students at the University of Science and Technology of China in Hefei, Anhui (years 2016 and 2017).

- **Magnetic Reconnection in Plasmas**, for PhD students in Physics and Nuclear Engineering at the Massachusetts Institute of Technology (year 2000-2001).

- **Physics of Plasmas**, for PhD students at the Polytechnic University of Turin (since 2016).

- **Physics I**, for 1st year students at the Polytechnic University of Turin, in English (since 2015).

- **Plasma Physics**, for students of the Degree Program in Physics (University of Turin).

- **Plasma Physics and Engineering**, for students of the Degree Programs in Physics, Nuclear and Energetics Engineering, Aerospace Engineering, Engineering Physics (Politecnico di Torino).

- **Physics of Nuclear Fusion Reactors**, for students of the Degree Program in Nuclear and Energetics Engineering (Politecnico di Torino).

- **Transport of Particles and Radiation**, for students of the Degree Program in Nuclear and Energetics Engineering (Politecnico di Torino).

- **Medical Applications of Nuclear Radiations**, for students of the Degree Program in Nuclear and Energetics Engineering (Politecnico di Torino).

- **Mathematical Methods for Nuclear Reactors**, for students of the Degree Program in Nuclear and Energetics Engineering (Politecnico di Torino).

- **Open Laboratories**, an Introduction to the Laboratories of the Polytechnic University of Turin, for undergraduate students (Politecnico di Torino).

- **Tokamak Physics and Controlled Thermonuclear Fusion**, for students of the Doctoral Program in Electrical Engineering (Politecnico di Torino).

- **Hamiltonian Methods for Fluids and Plasmas,** for students of the Doctoral Program in Fluid-Dynamics (Politecnico di Torino).

  Member of the Doctoral College in Fluid Dynamics (Politecnico di Torino).

  Advisor for several Master and PhD theses.

V. Description of work and main achievements as Scientific Attaché at the Embassy of Italy in Egypt

The main tasks of the Scientific Attaché at the Embassy of Italy in Egypt have been to:

- facilitate the scientific, technological and inter-university cooperation between Italy and Egypt;

- facilitate the transfer of technological know-how between Italian and Egyptian enterprises;

- assist Italian delegations visiting Egypt for initiatives related to S&T.;

- promote Italian science and culture in Egypt, as well as Egyptian science and culture in Italy through Egypt participation in events such as the Genoa Science Festival, EXPO2015 etc;

- assist Egyptian partners applying for funding opportunities within Europe, encourage Egypt's participation in EU-funded Programs;

- use Science Diplomacy as a vehicle for improving mutual understanding and cooperation between Egypt, Italy, Mediterranean and Arab Countries.

After my arrival in Cairo in 2007, Italy became the first partner of Egypt in terms of successful applications within the VII Framework Program, TEMPUS and ERASMUS MUNDUS projects.

Other achievements are as follows:

- Promoter and co-organizer of the 2009 Egyptian-Italian Year of Science and Technology. In the year 2009, more than eighty Italian scientific events (conferences, exhibitions, round table discussions, launch of cooperative projects, screening of documentary films, etc) were organized in Egypt and more than forty Egyptian scientific events in Italy.

- As a follow-up of the 2009 Egyptian-Italian Science Year, the project *Multi-Purpose Applications of Thermodynamic Solar* (MATS), coordinated by ENEA and including French, German, British and Egyptian partners, was funded by the EU (VII Framework Program). The project, which involved public research centers as well as private industries, aimed at establishing an experimental facility (at present under construction) in Egypt for the testing of innovative technologies in thermodynamic solar. The total cost of the project is 22.5 MEuro, of which 12.5 MEuro funded by EU and the rest by the industrial partners. It is the single, most important EU FP7 project for a facility constructed entirely outside the boundaries of the UE.

- I have contributed to the preparation of three Italian-Egyptian Inter-Governmental Summits (Rome, June 2008; Sharm El Sheikh, May 2009; Rome, May 2010). I have arranged meetings between the Ministers of Scientific Research of Italy and Egypt (November 2011). I have assisted in the preparation of the state visits of the Italian Foreign Minister in Egypt (January 2012) and of the Egyptian President Mohamed Morsi (September 2012), and several other state visits.

- I have organized the visit to Egypt of CNR President, Prof. Luigi Nicolais, on 24-25 March 2015. The visit produced two Agreements and Calls for the financing of joint projects between CNR and the Egyptian Ministry of Scientific Research. On the occasion of this visit, I have also organized the Italian-Egyptian Science Day at the National Research Center in Cairo in March 2015 and the Italian-Egypt Science Day in Turin on 15-16 June 2015.

- I have contributed to the preparation of several Memorandum of Understanding and Agreements between the Egyptian and the Italian Governments (especially those involving the Ministries of Higher Education, Scientific Research, Health and Environment), as well as Agreements and MoUs involving universities and research institutions of the two Countries (on the Italian side: National Research Council

of Italy, ENEA, Italian Space Agency, Mediterranean Institute of Hematology, University for Foreigners of Perugia, Union of the Mediterranean Universities, International Distance-Learning University UNINETTUNO, Agricultural Research Centre, Institute of Oceanography and Experimental Geophysics of Trieste, National Institute of Astrophysics, National Museum of the Antarctic, Experimental Zoo-Prophylactic Institute of the North-Eastern Italy, International Centre for Theoretical Physics of Trieste, and many others; on the Egyptian side: Bibliotheca Alexandrina, Academy for Scientific Research and Technology, National Research Centre, National Authority for Remote Sensing and Space Sciences, Egyptian e-learning University, Supreme Council of Universities and many others, as well as several Italian and Egyptian universities).

- I am the initiator and member of the Board of Directors of the Egyptian-Italian Centre for the Conservation of Antique Photographs and Paper Heritage, hosted by the Faculty of Fine Arts of Helwan University in Cairo. I have also promoted the International Master Course in Conservation of Antique Photographs and Paper Heritage, jointly organized by the University of Catania and Helwan University (Egypt).

- I have organized in 2010 the Joint Egyptian-Italian Geophysical expedition that discovered the Gebel Kamil Meteorite Crater in the Egyptian South-Western Desert. This sensational discovery was published in the journal *Science* and was reported by news agencies and science journals (including *National Geographic, Focus* etc) around the world.

- I have organized in Egypt the Plasma Physics conference: *1st NILES Conference on Lasers and Plasmas, Joined with the 10th Plasma Easter Meeting* (National Institute for Laser Enhanced Sciences, Cairo University, 16-18 March 2008) and several seminars of fusion and plasma applications. I have taken an interest in the EGYPTOR small tokamak experiment in Egypt. I have organized two conferences on nuclear-related topics: *Nuclear Fuel Supply Initiatives* (Diplomatic Club, Il Cairo, 8-9 March 2008); *International Conference on Nuclear Science and Education* (Cairo University, Faculty of Science, 17-19 March 2009).

- In collaboration with CNR, I have organized several conferences, symposia and training courses in the field of Technologies applied to Cultural Heritage, Museum Management and Multidisciplinary approaches for Archaeology.

- Member of the Joint Working Group for the Egyptian-Italian University. Member of the Scientific Committee of the Union of Mediterranean Universities (UNIMED).

- Curator of the Book *2009 Egyptian-Italian Year of Science and Technology* (Agenzia Italiana, Il Cairo, 2009) and co-publisher of the Book *Ippolito Rosellini and the Birth of Egyptology* (Agenzia Italiana, Il Cairo, 2010).

- Participation in the International SESAME project: a success story. SESAME stands for Synchrotron-light Experimental Science and Applications in the Middle East. At the beginning of 2012, I convinced the Italian Ambassador in Egypt to send a message to the Ministry of Foreign Affairs in Rome, pointing out that, in spite of its official role as Observer to the SESAME project, Italy had neglected the project and had failed to nominate an Italian delegate to the SESAME Council, in spite of the project's high relevance in terms of science diplomacy. Indeed, member Countries to the project, modeled after CERN, are: Egypt, Israel, Palestine, Jordan, Iran, Pakistan, Bahrein, Turkey and Cyprus. The SESAME Council is just about the only International organism where representatives from all these Countries meet regularly since 2004. Following this communication, in November 2012 I was appointed Italian Delegate to the SESAME Council. In 2013, The Italian Parliament approved a financial contribution of 1 MEuro for 2013 to the SESAME project, to be repeated for five consecutive years. In November 2013, an Italian scientist from the Elettra Laboratory in Trieste (Giorgio Paolucci) was appointed Scientific Director of the SESAME project.