PERSONAL INFORMATION

Michela Gelfusa

Via Roberto Malatesta 152, 00176 Rome, Italy

+390672597210

gelfusa@ing.uniroma2.it

Sex F | Date of birth | Nationality Italian

WORK EXPERIENCE

2022-present day

Associate Professor (IIND-07/C)

University of Rome "Tor Vergata" – Department of Industrial Engineering

Research interests primarily lie in the fields of energetic (nuclear fusion) and environmental physics, with applications spanning civil and military sectors.

2019-2022

Researcher (RTD-b)

University of Rome "Tor Vergata"– Department of Industrial Engineering

- Development of scientific instruments for atmospheric physics and fusion plasma applications
- Expert in solution of inverse problems, ranging from magnetic reconstructions to tomographic inversions.
- Long experience in data analysis machine learning, in particular for anomaly detection and disruption prediction.
-

2018-2019

Scholarship

University of Rome "Tor Vergata"– Department of Industrial Engineering

- Support to the Master in Nuclear Fusion

2012-2017

Researcher (RTD-a) – Department of Industrial Engineering

University of Rome "Tor Vergata"

- Development of scientific instruments for atmospheric physics and fusion plasma applications
- Expert in solution of inverse problems, ranging from magnetic reconstructions to tomographic inversions.
- Long experience in data analysis machine learning, in particular for anomaly detection and disruption prediction.

2008-present day

Visiting Scientist/Secondee

EUROFusion (EFDA) - JET (Joint European Torus)

- Implementation of new tomographic inversion method for neutrons, gamma-ray and bolometry
- Development of disruption predictors with implementation on both AUG and JET
- Support to equilibrium reconstruction with internal constraints
- Study of the optical and mechanical components of the JET interferometer/polarimeter
- Analysis of Polarimetric data, in particular: i) Cotton-Mouton in high current discharges; ii) Faraday rotation signals and implications on equilibrium. Also, analysis of calibration and use of Cotton-Mouton for fringe jump corrections.

2022-2023

Responsible officer
ITER Organization

ITER - Task Task request #13 ref IO/22/TR/10023628/BBE "Plant Support Team for 55.NE.X0 Development"

2021-2023

Responsible officer

ITER Organization

ITER - Task Order #8 “Integration Equatorial Port #2 towards its PDR” - under FWC 6000000323 “Diagnostic Infrastructure Development and Engineering Service”

2021-2022 **Principal Investigator**

Progetto Dipartimentale
PROMETHEUS (Bando "Beyond Borders" (D.R.1347/2019)).

2017-2018 **Responsible officer**

ITER Organization

- Task: “TO#07 - ECH-CTS stray loads testing for windows assembly” (contract number IO/16/CT/SAP 6000000181).

2010-2011 **Project leader**

EFDA - JET

- Project leader for the enhancement : JW10-OEP-ENEA-90 - Real-Time Measurement & Control: Diagnostics & Infrastructure (polarimeter)

2009-Nov 2012 **Research fellow**

University of Rome “Tor Vergata”

- Plasma Physics: development and implementation of diagnostics for high temperature plasmas.

2005-2006 **Scholarship**

University of Rome “Tor Vergata”

- Development of a Lidar/Dial system to detect harmful gases in atmosphere

EDUCATION AND TRAINING

2017 **Italian National Scientific Qualification as Associate Professor of Nuclear Engineering**

2009 **PhD in Quantum electronics and plasma physics**

University of Rome “Tor Vergata”

2005 **Master (2nd/higher level) in “Organization and Management of Companies and Health Services”**

Catholic University of Rome

2005 **Master’s Degree in Energy and Nuclear Engineering**

University of Rome “Tor Vergata”

Thesis: “Sviluppo di Codici Numerici per la Simulazione di un Incendio Boschivo: Applicazione al Dimensionamento di un Sistema di Telesorveglianza”

PERSONAL SKILLS

Mother tongue(s): Italian

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1

Communication skills

Good communication skills acquired as lecturer of “Diagnostic techniques for thermonuclear reactors” at University and as supervisor of several PhD and Master students.

Organisational / managerial skills

Leadership acquired during the coordination of International projects and during the supervision of international groups of scientists from various European Nations.

Job-related skills

Good familiarity with EUROfusion administrative and legal framework.

Computer skills

Operating systems: Windows, Mac OS X
Programming Languages: Matlab, Comsol Multiphysics (FEM), IDL, Python, Pascal
Software: AutoCAD, Zemax, LabView
Typesetting, DTP; LaTeX2e, Microsoft Office, Adobe Photoshop

Driving licence

▪ B

ADDITIONAL INFORMATION

1. Member of the Italian Order of Engineers since 2005
2. Member of the teaching/scientific panel of the "Industrial Engineering" PhD program of Rome "Tor Vergata" University since 2017.
3. Author of more than 220 papers on International Journals
4. Member of International Advisory Board of the International Conference Frontiers in Diagnotics Technologies (ICFDT).

Publications (last 5 years)

1. Murari, A., Rossi, R., Craciunescu, T., Vega, Gelfusa, M., JET Contributors, A control oriented strategy of disruption prediction to avoid the configuration collapse of tokamak reactors (2024) Nature Communications, 15 (1), art. no. 2424, .
2. Wyss, I., Murari, A., Peluso, E., Gelfusa, M., Gaudio, P., Rossi, R., On the accuracy of a fast time resolution inversion method for the detection of different radiation patterns in fusion reactors, (2024) Fusion Engineering and Design, 205, art. no. 114527, .
3. Gelfusa, M., Rossi, R., Murari, A., Causality Detection and Quantification by Ensembles of Time Delay Neural Networks for Application to Nuclear Fusion Reactors, (2024) Journal of Fusion Energy, 43 (1), art. no. 7
4. Noce, S., Villari, R., Colangeli, A., Flammini, D., Fonnesu, N., Gaudio, P., Gelfusa, M., Grasso, E., Guirao, J., Mariano, G., Mercuri, F., Moro, F., Previti, A., Shigin, P., Soro, S., Udintsev, V.S., Wyss, I., Nuclear analyses for the integration of ITER equatorial Port 2, (2024) Fusion Engineering and Design, 202, art. no. 114286
5. Rossi, R., Gelfusa, M., Craciunescu, T., Wyss, I., Vega, J., Murari, A., on behalf of JET Contributors, A hybrid physics/data-driven logic to detect, classify, and predict anomalies and disruptions in tokamak plasmas, (2024) Nuclear Fusion, 64 (4), art. no. 046017
6. Sano, G.D., Luca, R.D., Dose, G., Palumbo, M.F., Gelfusa, M., Martelli, E., Polli, G.M., Riccardi, B., Roccella, S., Neu, R., Thermo-Hydraulic Design of the First Wall of the DTT Facility, (2024) IEEE Transactions on Plasma Science, pp. 1-0
7. Murari, A., Peluso, E., Spolladore, L., Rossi, R., Gelfusa, M., Upgrades of Genetic Programming for Data-Driven Modeling of Time Series, (2023) Evolutionary Computation, 31 (4), pp. 401-432
8. Craciunescu, T., Peluso, E., Murari, A., Bernert, M., Gelfusa, M., Rossi, R., Spolladore, L., Wyss, I., David, P., Henderson, S., Fevrier, O., ASDEX Upgrade Team, Maximum likelihood bolometry for ASDEX upgrade experiments, (2023) Physica Scripta, 98 (12), art. no. 125603
9. Rossi, R., Gelfusa, M., Murari, A., On the potential of physics-informed neural networks to solve inverse problems in tokamaks, (2023) Nuclear Fusion, 63 (12), art. no. 126059
10. Murari, A., Rossi, R., Spolladore, L., Lungaroni, M., Gaudio, P., Gelfusa, M., A practical utility-based but objective approach to model selection for regression in scientific applications, (2023) Artificial Intelligence Review, 56, pp. 2825-2859
11. Murari, A., Spolladore, L., Rossi, R., Gelfusa, M.,Combining dimensional and statistical analysis for efficient data driven modelling of complex systems, (2023) Information Sciences, 644, art. no. 119243
12. Noce, S., Flammini, D., Gaudio, P., Gelfusa, M., Mazzone, G., Moro, F., Romanelli, F., Villari, R., Wyss, I., You, J.-H., Analysis of the nuclear loads on Chromium monoblock divertor target for DEMO, (2023) Fusion Engineering and Design, 194, art. no. 113866
13. Wyss, I., Murari, A., Spolladore, L., Peluso, E., Gelfusa, M., Gaudio, P., Rossi, R., on-behalf-of-JET-contributors, Comparison of a fast low spatial resolution inversion method and peaking factors for the detection of anomalous radiation patterns and disruption prediction, (2023) Fusion Engineering and Design, 193, art. no. 113625
14. Rossi, R., Gelfusa, M., Craciunescu, T., Spolladore, L., Wyss, I., Peluso, E., Vega, J., Maggi, C.F., Mailloux, J., Maslov, M., Murari, A., Jet Contributors, A systematic investigation of radiation collapse for disruption avoidance and prevention on JET tokamak, (2023) Matter and Radiation at Extremes, 8 (4), art. no. 046903
15. Peluso, E., Murari, A., Craciunescu, T., Carvalho, P., Gelfusa, M., Gaudio, P., Wyss, I., JET Contributors, Correction of JET bolometric maximum likelihood tomography for local gas puffing, (2023) Plasma Physics and Controlled Fusion, 65 (7), art. no. 075003

Publications (last 5 years)

16. Murari, A., Rossi, R., Gelfusa, M., Combining neural computation and genetic programming for observational causality detection and causal modelling, (2023) Artificial Intelligence Review, 56 (7), pp. 6365-6401

17. Peluso, E., Pakhomova, E., Gelfusa, M., New Challenges in Nuclear Fusion Reactors: From Data Analysis to Materials and Manufacturing, (2023) Applied Sciences (Switzerland), 13 (10), art. no. 6240

18. Spolladore, L., Rossi, R., Wyss, I., Gaudio, P., Murari, A., Gelfusa, M., JET Contributors, Detection of MARFEs using visible cameras for disruption prevention, (2023) Fusion Engineering and Design, 190, art. no. 113507

19. Gelfusa, M., Murari, A., Ludovici, G.M., Franchi, C., Gelfusa, C., Malizia, A., Gaudio, P., Farinelli, G., Panella, G., Gargiulo, C., Casinelli, K., On the Potential of Relational Databases for the Detection of Clusters of Infection and Antibiotic Resistance Patterns, (2023) Antibiotics, 12 (4), art. no. 784

20. Noce, S., Flammini, D., Gaudio, P., Gelfusa, M., Mazzone, G., Moro, F., Romanelli, F., Villari, R., You, J.-H., Neutronics Assessment of the Spatial Distributions of the Nuclear Loads on the DEMO Divertor ITER-like Targets: Comparison between the WCLL and HCPB Blanket, (2023) Applied Sciences (Switzerland), 13 (3), art. no. 1715

21. Murari, A., Gelfusa, M., Craciunescu, T., Gelfusa, C., Gaudio, P., Bovesecchi, G., Rossi, R., Effects of environmental conditions on COVID-19 morbidity as an example of multicausality: a multi-city case study in Italy, (2023) Frontiers in Public Health, 11, art. no. 1222389

22. Murari, A., Lungaroni, M., Spolladore, L., Peluso, E., Rossi, R., Gelfusa, M., Information theoretic and neural computational tools for meta-analysis of cumulative databases in the age of Big Physics experiments, (2023) Neural Computing and Applications, 35 (1), pp. 469-486

23. Craciunescu, T., Murari, A., Peluso, E., Lang, P.T., Harrer, G., Spolladore, L., Gelfusa, M., JET Contributors, the ASDEX Upgrade Team, A methodology for discriminating phase and amplitude effects on synchronization in tokamak pacing experiments, (2022) Frontiers in Physics, 10, art. no. 985422

24. Filippi, F., Fiorucci, D., Fassina, A., Giudicotti, L., Mazzotta, C., Rocchi, G., Rossi, R., Terranova, D., Tudisco, O., Andreoli, P., Cipriani, M., Consoli, F., Gaudio, P., Gelfusa, M., Innocente, P., Mauro, G., Mascali, D., Naselli, E., Orsitto, F., Torrisi, G., Study for a tangential dispersion interferometer/polarimeter for DTT, (2022) Journal of Instrumentation, 17 (8), art. no. C08023

25. Peluso, E., Murari, A., Craciunescu, T., Lerche, E., Gaudio, P., Gelfusa, M., Gallart, D., Taylor, D., Conditional recurrence plots for the investigation of sawteeth pacing with RF modulation, (2022) Plasma Physics and Controlled Fusion, 64 (8), art. no. 084002

26. Gelfusa, M., Donnini, R., Vila, R., Simonetto, A., Bruschi, A., Cucè, D., Lazzari, A., Maquet, P., Mirizzi, F., Murari, A., Nobili, M., Peluso, E., Romanelli, F., Sirinelli, A., Sozzi, C., Proposal of a testing procedure to qualify ITER window assemblies and absorbing coatings exposed to high microwave stray radiation, (2022) Fusion Engineering and Design, 181, art. no. 113209

27. Vega, J., Murari, A., Dormido-Canto, S., Rattá, G.A., Gelfusa, JET Contributors, Disruption prediction with artificial intelligence techniques in tokamak plasmas, (2022) Nature Physics, 18 (7), pp. 741-750

28. Rossi, R., Cesaroni, S., Bombarda, F., Gaudio, P., Gelfusa, M., Marinelli, M., Rinati, G.V., Peluso, E., JET Contributors, An Unsupervised Spectrogram Cross-Correlation Method to Assess ELM Triggering Efficiency by Pellets, (2022) Applied Sciences (Switzerland), 12 (7), art. no. 3681

29. Peluso, E., Gelfusa, M., Craciunescu, T., Martellucci, L., Gaudio, P., Carvalho, P., Murari, A., JET Contributors, Dealing with artefacts in JET iterative bolometric tomography using masks, (2022) Plasma Physics and Controlled Fusion, 64 (4), art. no. 045013

30. Rossi, R., Gelfusa, M., Flanagan, J., Murari, A., JET Contributors, Development of robust indicators for the identification of electron temperature profile anomalies and application to JET, (2022) Plasma Physics and Controlled Fusion, 64 (4), art. no. 045002

31. Murari, A., Peluso, E., Spolladore, L., Vega, J., Gelfusa, M., Considerations on Stellarator's Optimization from the Perspective of the Energy Confinement Time Scaling Laws, (2022) Applied Sciences (Switzerland), 12 (6), art. no. 2862

32. Fiorucci, D., Fassina, A., Filippi, F., Mazzotta, C., Rocchi, G., Rossi, R., Terranova, D., Tudisco, O., Andreoli, P., Cipriani, M., Consoli, F., Gaudio, P., Gelfusa, M., Giudicotti, L., Innocente, P., Belpane, A., Mauro, G., Mascali, D., Naselli, E., Orsitto, F.P., Torrisi, G., Advances in the DTT poloidal interferometer/polarimeter design, (2022) Journal of Instrumentation, 17 (2), art. no. C02023

Publications (last 5 years)

33. Murari, A., Peluso, E., Craciunescu, T., Dormido-Canto, S., Lungaroni, M., Rossi, R., Spolladore, L., Vega, J., Gelfusa, M., Frontiers in data analysis methods: From causality detection to data driven experimental design, (2022) Plasma Physics and Controlled Fusion, 64 (2), art. no. 024002

34. Murari, A., Lungaroni, M., Rossi, R., Spolladore, L., Gelfusa, M., Complexity: Frontiers in Data-Driven Methods for Understanding, Prediction, and Control of Complex Systems 2022 on the Development of Information Theoretic Model Selection Criteria for the Analysis of Experimental Data, (2022) Complexity, 2022, art. no. 9518303

35. Murari, A., Gelfusa, M., Lungaroni, M., Gaudio, P., Peluso, E., A systemic approach to classification for knowledge discovery with applications to the identification of boundary equations in complex systems, (2022) Artificial Intelligence Review, 55 (1), pp. 255-289

36. Murari, A., Peluso, E., Vega, J., García-Regaña, J.M., Velasco, J.L., Fuchert, G., Gelfusa, M., Scaling laws of the energy confinement time in stellarators without renormalization factors, (2021) Nuclear Fusion, 61 (9), art. no. 096036

37. Spolladore, L., Gelfusa, M., Rossi, R., Murari, A., Improved treatment of the independent variables for the deployment of model selection criteria in the analysis of complex systems, (2021) Entropy, 23 (9), art. no. 1202

38. Gelfusa, M., Craciunescu, T., Peluso, E., Giacomelli, L., Kiptily, V., Reux, C., Szepesi, G., Murari, A., Contributors, J.E.T., A maximum likelihood tomographic method applied to JET gamma ray emission during the current quench, (2021) Fusion Engineering and Design, 168, art. no. 112637

39. Rossi, R., Boboc, A., Orsitto, F.P., Gelfusa, M., Gaudio, P., First measurements of line-integrated electron density in an ITER-like configuration using the JET far infrared polarimeter diagnostic, (2021) Plasma Physics and Controlled Fusion, 63 (4), art. no. 045008

40. Murari, A., Rossi, R., Lungaroni, M., Baruzzo, M., Gelfusa, M., Stacking of predictors for the automatic classification of disruption types to optimize the control logic, (2021) Nuclear Fusion, 61 (3), art. no. 036027

41. Rossi, R., Gelfusa, M., De Masi, F., Ossidi, M., Murari, A., The Reciprocal Influence Criterion: An Upgrade of the Information Quality Ratio, (2021) Complexity, 2021, art. no. 9426547

42. Murari, A., Peluso, E., Lungaroni, M., Gaudio, P., Vega, J., Gelfusa, M., Data driven theory for knowledge discovery in the exact sciences with applications to thermonuclear fusion, (2020) Scientific Reports, 10 (1), art. no. 19858

43. Rossi, R., Gelfusa, M., Malizia, A., Gaudio, P., Adaptive quasi-unsupervised detection of smoke plume by lidar, (2020) Sensors (Switzerland), 20 (22), art. no. 6602, pp. 1-11

44. Peluso, E., Rossi, R., Murari, A., Gaudio, P., Gelfusa, M., ASDEX Upgrade Team, EUROfusion MST1 Team, Alternative detection of n = 1 modes slowing down on ASDEX upgrade, (2020) Applied Sciences (Switzerland), 10 (21), art. no. 7891, pp. 1-14

45. Murari, A., Peluso, E., Lungaroni, M., Rossi, R., Gelfusa, M., JET Contributors, Investigating the physics of tokamak global stability with interpretable machine learning tools, (2020) Applied Sciences (Switzerland), 10 (19), art. no. 6683

46. Gelfusa, M., Rossi, R., Lungaroni, M., Belli, F., Spolladore, L., Wyss, I., Gaudio, P., Murari, A., JET Contributors, Advanced pulse shape discrimination via machine learning for applications in thermonuclear fusion, (2020) Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 974, art. no. 164198

47. Craciunescu, T., Murari, A., Lerche, E., Gelfusa, M., JET Contributors, Image-based methods to investigate synchronization between time series, (2020) Entropy, 22 (7), art. no. 775

48. Murari, A., Rossi, R., Peluso, E., Lungaroni, M., Gaudio, P., Gelfusa, M., Ratta, G., Vega, J., JET Contributorsb and ASDEX Upgrade Team, On the transfer of adaptive predictors between different devices for both mitigation and prevention of disruptions, (2020) Nuclear Fusion, 60 (5), art. no. 056003

49. Rossi, R., Murari, A., Gaudio, P., Gelfusa, M., Upgrading model selection criteria with goodness of fit tests for practical applications, (2020) Entropy, 22 (4), art. no. 447

50. Murari, A., Peluso, E., Craciunescu, T., Lowry, C., Aleiferis, S., Carvalho, P., Gelfusa, M., JET Contributors, Investigating the thermal stability of highly radiative discharges on JET with a new tomographic method, (2020) Nuclear Fusion, 60 (4), art. no. 046030

51. Murari, A., Rossi, R., Lungaroni, M., Gaudio, P., Gelfusa, M., Quantifying total influence between variables with information theoretic and machine learning techniques, (2020) Entropy, 22 (2), art. no. 141

52. Murari, A., Lungaroni, M., Gelfusa, M., Testing the consistency of multimachine databases for physical studies of regression, (2020) Nuclear Fusion, 60 (1), art. no. 015001

53. Romanelli, F., Gelfusa, M., On the optimal mix of renewable energy sources, electrical energy storage and thermoelectric generation for the de-carbonization of the Italian electrical system, (2020) European Physical Journal Plus, 135 (1), art. no. 72

Relevant Conferences

1. Invited lecture at "Summer School of Plasma Diagnostics: PhDiaFusion 2023". Institute of Nuclear Physics, Polish Academy of Sciences.This fifth edition of the Summer School is entitled "Artificial intelligence for plasma diagnostics and controlled fusion".
2. Oral presentation at the 6th International Conference Frontiers in Diagnostic Technologies, ENEA Frascati, 19-21 October 2022. Title of the talk: How to Investigate Disruption Physics using Machine Learning Tools.
3. Oral presentation at 14th Chaotic Modeling and Simulation International Conference 8 - 11 June, 2021, Athens, Greece. Title of the oral presentation: "Complex Networks and Causality between Time Series"
4. IAEA Technical Meeting on Plasma Disruptions and their Mitigation Oral presentation: "On the Potential of Adaptive Predictors and their Transfer between Different Devices for both Mitigation and Prevention of Disruptions". (2020).
5. 31st Symposium on Fusion Technology (SOFT2020), 20th - 25th September 2020
   Poster: "A Maximum Likelihood Tomographic Method applied to JET Gamma Ray Emission during the Current Quench".
6. 3rd IAEA Technical Meeting on Fusion Data Processing, Validation and Analysis, 28-31 Maggio 2019, Vienna (Austria). Oral presentation: "Adaptive Learning Based on Ensembles of Classifiers for Disruption Prediction on the Route to ITER".
7. Craciunescu, T., Murari, A., Peluso, E., Gelfusa, M., Lungaroni, M., Gaudio, P., Complex networks for the analysis of the synchronization of time series relevant for plasma fusion diagnostics (2017), 2017 European Conference on Circuit Theory and Design, ECCTD 2017, art. no. 8093302.
8. Murari, A., Talebzadeh, S., Vega, J., Peluso, E., Gelfusa, M., Lungaroni, M., Gaudio, P., A metric to improve the robustness of conformal predictors in the presence of error bars, (2016) Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 9653, pp. 105-115.

Guest Editor

1.Journal Applied Sciences - Special Issue: "Special Issue "Recent Developments in Fusion Plasma Diagnostics"
(https://www.mdpi.com/journal/applsci/special_issues/Recent_Developments_Fusion_Plasma_Diagnostics)

2. Annual Issue: Frontiers in Data-Driven Methods for Understanding, Prediction, and Control of Complex Systems 2021 (https://www.hindawi.com/journals/complexity/si/626918/)

3. Journal Applied Sciences - Special Issue "Recent Developments in Fusion Plasma Diagnostics" (https://www.mdpi.com/journal/applsci/special_issues/Recent_Developments_Fusion_Plasma_Diagnostics)

Honours and awards

1.Best Paper Award: A. Murari, E. Peluso, S. Talebzadeh, P. Gaudio, M. Lungaroni, O. Mikulin, J. Vega and M. Gelfusa, Deriving realistic mathematical models from support vector mchines for scientific applications, 9th International Conference on Knowledge Discovery and Information Retreval, Madeira (Portugal) 2017

2.Best Paper Award: M. Carestia ; R. Pizzoferrato ; M. Lungaroni ; J. Gabriele ; G. M. Ludovici, O. Cenciarelli, M. Gelfusa, et al., "Multispectral analysis of biological agents to implement a quick tool for stand-off biological detection", Proc. SPIE 9652, Optics and Photonics (2015)

3. Best Poster: A. Murari, M. Lungaroni, E. Peluso, M. Gelfusa and P. Gaudio, Symbolic Regression With Different Metrics To Investigate Scaling Laws In Tokamaks, 1st EPS conference on Plasma Diagnostics, 14-17 April 2015 Frascati, Italy

Italian Patent

VERNICE FOTOCATALITICA - N. ITRM20110507 del 28/03/2013