

Enrico Aymerich

Date of Birth 13/05/1996 Address: Via Geronimo Zurita, 2 Cagliari, Italy 09125 Phone: +39 3925704033 Mail: enrico.aymerich@unica.it

Education

PhD, Industrial Engineering

University of Cagliari, Italy, 2019 – 2023 Dissertation: 20/04/2023

Thesis: Machine Learning and Deep Learning applications for the protection of nuclear fusion devices

• Supervisor Prof. Alessandra Fanni, Dr. Fabio Pisano Final mark: passed magna cum laude

Master of Science in Electronic Engineering

University of Cagliari, Italy, 2017 - 2019

 Thesis: Automatic identification of destabilizing mechanisms in Tokamaks Supervisor: Prof. Alessandra Fanni Final degree mark: 110/110 magna cum laude University of Cagliari prize as best graduate of the course University of Cagliari prize as best graduate of the Engineering and Architecture Faculty Consorzio RFX Best Thesis in <u>Nuclear Fusion Engineering</u>

Bachelor of Science in Electrical and Electronic Engineering,

University of Cagliari, Italy, 2014 - 2017

 Thesis: Analisi statistica delle disrupzioni nei Tokamak Supervisor: Prof. Alessandra Fanni Final degree mark: 110/110 magna cum laude University prize as best graduate of the course

Research/work Experience and internships

Member of research team:

- EUROfusion program on DEMO design WPDES: 2023
- EUROfusion program on Tokamak exploitation WPTE: 2021, 2022-23 Topic RT04
- EUROfusion program on JET experimental campaigns WPJET1: 2021 Task M21-03 and Task; 2020 Task M18-04
- EUROfusion program on W7-X OP1.2b: 2020-21 Task S1.X2.A.T2 and Task S1.X2.A.T2;
- EUROfusion Work Program WPW7X: W7-X Exploitation Task: 2023-W7X-3.3.2-ENEA-UC: Preparation and Support for W7-X Experiments in 2023

PostDoc

Department of Electrical and Electronic Engineering, University of Cagliari, Italy January 2023-ongoing

• Development of machine and deep learning techniques for the monitoring of dangerous events in nuclear fusion devices

Visiting researcher

Fusion Technology Department Max Planck Institute for Plasma Physics Garching, Garching, Germany August 2023-September 2023

• Detection of flux pumping at JET by nonlinear transport simulations

Visiting PhD student

Max Planck Institute for Plasma Physics Greifswald, Greifswald, Germany September 2021 - February 2022

• Development of codes for real-time heat flux computation using Physics Informed Neural Networks (PINN).

Internship

UK Atomic Energy Authority / Culham Centre for Fusion Energy, Culham, UK, November 2018 - February 2019

• Development of an SVD (Singular Values Decomposition) algorithm and test of a Coherence algorithm to identify MHD modes in the plasma. This internship was supported by <u>Fusenet</u>

Research Assistant

Department of Electrical and Electronic Engineering, University of Cagliari, Italy April 2018-September 2018

• Participation in the DigitArch project, developing AR, VR and MR solutions for real estate and construction engineering.

Internship

UK Atomic Energy Authority / Culham Centre for Fusion Energy, Culham, UK,

July 2017 – September 2017

• Carried out work on the statistical analysis of some relevant signals of the plasma physics and state during discharges in JET Tokamak. This internship was supported by an Erasmus+Traineeship scholarship

Teaching Experience

Professor: Electrotechnics, BSc in Tecnologie Industriali per la Transizione Energetica e Digitale, University of Cagliari, Cagliari, Italy, 2023-2024

• Bachelor level course on fundamental of circuit theory.

Tutor: Electrotechnics, BSc in Electrical and Electronic Engineering, University of Cagliari, Cagliari, Italy, 2019-2023

• Bachelor level course on fundamental of circuit theory. Responsible for practical assignments and student support

Seminars: BSc in Electrical and Electronic Engineering, University of Cagliari, Cagliari, Italy, 2019-2022

- LTSPICE for circuit simulation
- Introduction to Matlab for solving electrical circuits

Grants/Scholarships

EUROfusion Engineering Grant 2024

2024: Two-year salary and missions funded by EUROfusion

Mobilità Giovani Ricercatori (MGR) researcher grant

2023, supporting the 1-month visiting researcher period at the Max Planck Institut für Plasmaphysik Garching, Fusion technology department.

Research Grants - Bi-nationally Supervised Doctoral Degrees / Cotutelle • DAAD

2021-22, supporting the visiting PhD period at the Max Planck Institüt für Plasmaphysik Greifswald

Fusenet Master support

2018-19, supporting the visiting Master period at Culham Science Centre, Culham, UK

Erasmus+traineeship

2017, supporting the internship period at Culham Science Centre, Culham, UK

Summer schools/courses

- Computational Physics School for Fusion Research (CPS-FR) 2022, organized by MIT, Boston, Massachusetts
- ITER Summer School 2022 (ISS2022) on plasma control, San Diego, California
- Advanced course on plasma physics and diagnostics: PhD course of the University of Padua, Italy
- Advanced course on plasma control: PhD course of the University of Padua, Italy
- Advanced course on fusion technology: PhD course of the University of Padua, Italy
- SUMTraic 2019: Summer training course on COMPASS tokamak
- PlasmaSurf 2018: Summer course on plasma physics, intense lasers and nuclear fusion + Internship

Others

- Reviewer for Nuclear fusion, Journal of plasma physics, IEEE Transactions on Plasma Science
- Finalist for the prize "Advancing Technology for Humanity, most promising researcher in robotics and artificial intelligence" for researchers in AI under 40 years old (shortlist of 20 over 135 applicants) <u>https://romecup.org/roboticaward/</u>

Languages

Italian: Native English: Advanced (C1) German: Basic (A2)

List of Publications

PEER-REVIEWED JOURNAL PUBLICATIONS

- 1) Aymerich, E., F. Pisano, B. Cannas, G. Sias, A. Fanni, Y. Gao, D. Böckenhoff, and M. Jakubowski. 2023. 'Physics Informed Neural Networks towards the Real-Time Calculation of Heat Fluxes at W7-X'. Nuclear Materials and Energy 34 (March): 101401. https://doi.org/10.1016/j.nme.2023.101401.
- 2) Aymerich, E., G. Sias, F. Pisano, B. Cannas, A. Fanni, and the-JET-Contributors. 2023. 'CNN Disruption Predictor at JET: Early versus Late Data Fusion Approach'. Fusion Engineering and Design 193 (August): 113668. https://doi.org/10.1016/j.fusengdes.2023.113668.
- 3) Aymerich, E., Barbara Cannas, Fabio Pisano, Giuliana Sias, Carlo Sozzi, Chris Stuart, Pedro Carvalho, Alessandra Fanni, and the JET Contributors. 2023. 'Performance Comparison of Machine Learning Disruption Predictors at JET'. Applied Sciences 13 (3): 2006. https://doi.org/10.3390/app13032006.
- 4) Aymerich, E., Giuliana Sias, Fabio Pisano, Barbara Cannas, Sara Carcangiu, Carlo Sozzi, Chris Stuart, Pedro Carvalho, and Alessandra Fanni. 2022. 'Disruption Prediction at JET through Deep Convolutional Neural Networks Using Spatiotemporal Information from Plasma Profiles'. Nuclear Fusion 62: 066005. https://doi.org/10.1088/1741-4326/ac525e.
- 5) Aymerich, E., A. Fanni, G. Sias, S. Carcangiu, B. Cannas, A. Murari, and A. Pau. 2021. 'A Statistical Approach for the Automatic Identification of the Start of the Chain of Events Leading to the Disruptions at JET'. Nuclear Fusion 61 (3): 036013. https://doi.org/10.1088/1741-4326/abcb28.
- 6) <u>Lacquaniti, M., G. Sias, A. Fanni, A. Pironti, F. Giorgetti, G. Calabrò, E. Aymerich, and M. Baruzzo. 2023.</u> <u>'White Noise Characterization and Thermo-Mechanical Analysis of DTT Pick-up Coils'. Fusion Engineering</u> <u>and Design 192 (July): 113775. https://doi.org/10.1016/j.fusengdes.2023.113775.</u>
- 7) <u>Mailloux, J., O. Adabonyan, P. Adrich, V. Afanasev, M. Afzal, T. Ahlgren, L. Aho-Mantila, et al. incl. E.</u> <u>Aymerich 2022.</u> 'Overview of JET Results for Optimising ITER Operation'. Nuclear Fusion 62 (4): 042026. <u>https://doi.org/10.1088/1741-4326/ac47b4.</u>
- Mazzi, S., J. Garcia, D. Zarzoso, Ye O. Kazakov, J. Ongena, M. Dreval, M. Nocente, et al. Incl. E. Aymerich 2022. 'Enhanced Performance in Fusion Plasmas through Turbulence Suppression by Megaelectronvolt Ions'. Nature Physics 18 (7): 776–82. https://doi.org/10.1038/s41567-022-01626-8.
- 9) <u>Vega, J., A. Murari, S. Dormido-Canto, G. A. Rattá, M. Gelfusa incl. **E. Aymerich** 2022. 'Disruption Prediction with Artificial Intelligence Techniques in Tokamak Plasmas'. Nature Physics 18 (7): 741–50. <u>https://doi.org/10.1038/s41567-022-01602-2.</u></u>
- 10) <u>Pedersen, Thomas Sunn, I. Abramovic, P. Agostinetti, M. Agredano Torres, S. Äkäslompolo, J. Alcuson</u> <u>Belloso, P. Aleynikov, et al. Incl. E. Aymerich</u> 2022. 'Experimental Confirmation of Efficient Island Divertor <u>Operation and Successful Neoclassical Transport Optimization in Wendelstein 7-X'. Nuclear Fusion 62 (4):</u> <u>042022. https://doi.org/10.1088/1741-4326/ac2cf5.</u>

PROCEEDINGS

- 1) <u>Corona, D, A Torres, **E Aymerich**, A Cianciulli, A De Falco, B B Carvalho, H Figueredo, H Alves, and H Fernandes. 2020. 'Extraction of the Plasma Current Contribution from the Numerically Integrated Magnetic Signals in ISTTOK'. Journal of Instrumentation. https://doi.org/10.1088/1748-0221/15/02/C02020.</u>
- 2) Aymerich, E, D Medda, and Y Mirko Anoffo. 2018. 'An Analysis of Depth Camera Devices for Engineering Applications'. In 2018 26th Telecommunications Forum, TELFOR 2018 - Proceedings. https://doi.org/10.1109/TELFOR.2018.8611921.
- 3) <u>Medda, D, E Aymerich, and Y Mirkoanoffo. 2018. 'Analysis of Synthetic Light Field Data Compression</u> <u>Performances'. In 2018 26th Telecommunications Forum, TELFOR 2018 - Proceedings.</u> <u>https://doi.org/10.1109/TELFOR.2018.8611808.</u>
- 4) <u>Anoffo, Y M, **E Aymerich**, and D Medda. 2018. 'Virtual Reality Experience for Interior Design Engineering</u> <u>Applications'. In 2018 26th Telecommunications Forum, TELFOR 2018 - Proceedings.</u> <u>https://doi.org/10.1109/TELFOR.2018.8612026.</u>