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Mario Merino Martínez

Academic positions

- 2018–present **Associate Professor (Profesor titular)**, *Universidad Carlos III de Madrid*, Escuela Politécnica Superior, Departamento de Bioingeniería e Ingeniería Aeroespacial.
- 2013–2018 **Assistant Professor (Profesor visitante)**, *Universidad Carlos III de Madrid*, Escuela Politécnica Superior, Departamento de Bioingeniería e Ingeniería Aeroespacial.
- 2010–2013 **Assistant researcher/teacher (Profesor ayudante)**, *Universidad Politécnica de Madrid*, Escuela Técnica Superior de Ingenieros Aeronáuticos (ETSIA), Departamento de Fundamentos Matemáticos de la Tecnología Aeronáutica.

Education

- 2010–2013 **PhD in Aerospace Engineering**, *Universidad Politécnica de Madrid*.
- Thesis: *Analysis of Magnetic Nozzles For Space Plasma Thrusters*. Awarded Cum Laude and the International PhD Thesis Mention by the Ministry of Education. Thesis advisor: Prof. Eduardo Ahedo.
- 2010–2012 **Postgraduate Master in Aerospace Engineering**, *Universidad Politécnica de Madrid*.
- 2004–2010 **Aerospace Engineering, Major in 'Aerospace Vehicles'**, *Universidad Politécnica de Madrid*, (5-year program, equivalent to BSc + MSc).
- **ERASMUS exchange year** at TU Delft, the Netherlands (academic year 2007/08).
- 2002–2004 **International Baccalaureate**, *I.E.S. Cardenal López de Mendoza*, Burgos, Spain.
- Grade: 41/45 (with Honors).

Academic awards and scholarships

Celera Program, *Selected among the top 10 Spanish young professionals of the year*, <http://www.acelerame.org/> (2017).

Accesit award in the Actúa-UPM competition for entrepreneurship and creation of technology-based businesses, *for the business plan 'VECMAN, steerable magnetic nozzle'*, awarded by *Universidad Politécnica de Madrid* (2015).

SENER Foundation special award to best Engineering PhD Thesis, awarded by *SENER Foundation* (2014).

Universidad Politécnica de Madrid Outstanding PhD Thesis award, awarded by *Universidad Politécnica de Madrid* (2014).

Electric Rocket Propulsion Society (ERPS) IEPC 2011 Best Paper Award, *to the paper 'On electron inertia and current ambipolarity in Magnetic Nozzle models,' by E. Ahedo and M. Merino*, IEPC-2011-050, awarded by *ERPS* (2011).

Second National Award on Outstanding Graduation in Aerospace Engineering, (Segundo Premio Extraordinario Fin de Carrera), awarded by the Ministry of Education, Spanish Government (2010).

First Prize in the “VII Pegasus-AIAA European Student Conference”, awarded by the AIAA and PEGASUS association of European Aerospace Universities (2010).

Second Prize in the “IX National Archimedes Contest for Young Researchers”, awarded by the Spanish Government (2010).

Young Aerospace Engineer of the Year Award, awarded by Aerospace Testing and EUCASS (2010).

EPS Best Poster at the ESCAMPIG XX Congress, awarded by the European Physical Society (7/2010).

Competitive scholarships and personal grants:

- 2014 **UC3M mobility grant**, Universidad Carlos III de Madrid, for research internship at UCLA, CA, USA (three months).
- 2012 **PhD scholarship ‘Beca para la Formación de Profesorado Universitario’ (FPU)**, Spanish Ministry of Education, scholarship granted; resigned to it in favor of my contract at Universidad Politécnica de Madrid in the same period.
- 2010 **Scholarship ‘Beca de Colaboración’**, Spanish Ministry of Education, obtained during my last year of Aerospace Engineering studies at Universidad Politécnica de Madrid.
- 2009–2010 **Scholarship ‘Beca de Colaboración’**, Universidad Politécnica de Madrid, involved teaching calculus and linear algebra courses as teaching assistant.
- 2004–2009 **Five consecutive Academic Excellence Grants**, Community of Madrid, obtained during my Aerospace Engineering studies at Universidad Politécnica de Madrid.

Research activity

Research group: Plasmas and Space Propulsion Team (EP2), ep2.uc3m.es.

Research interests: Plasma space propulsion, magnetic nozzles, helicon plasma thrusters, electron-cyclotron resonance thrusters, fluid and kinetic plasma models, expansion of magnetized and unmagnetized plasma plumes, electromagnetic waves in plasmas, numerical methods and analysis, space systems engineering, active space debris removal, nanosatellites, cubesats.

Research grants in competitive calls:

- 2021–2025 **ZARATHUSTRA: Revolutionizing advanced electrodeless plasma thrusters for space transportation**, supported by the European Research Council, ERC-2020-STG, Grant number: 950466, (1.5 M€).
Principal Investigator: Mario Merino.
- 2020–2022 **SPEOS: Electric Space Propulsion for Earth Orbit Satellites**, supported by the Ministry of Science and Innovation, National I+D plan, Spanish Government, Grant number: PID2019-108034RB-I00, (188.5 k€).
Principal Investigators: Pablo Fajardo, Mario Merino.

- 2020–2021 **MARETERRA: Resolviendo el transporte anómalo en motores de plasma de efecto Hall mediante técnicas data-driven robustas de análisis modal**, supported by the *Community of Madrid*, (60 k€).
Principal Investigator: Mario Merino, Filippo Terragni.
- 2020–2021 **SIMTURB: Simulación Numérica de la Turbulencia en Propulsión Espacial Eléctrica: Sinergias con Plasmas de Fusión**, supported by the *Community of Madrid*, (60 k€).
Principal Investigator: Pablo Fajardo, Jose Miguel Reynolds.
- 2020–2023 **HIPATIA: Hellcon Plasma Thruster for In-space Applications**, supported by the *H2020 Program (European Commission)*, Grant number: 870542, (455 k€).
Principal Investigator: Pablo Fajardo.
Project Manager: SENER Aerospace (Spain).
- 2019–2021 **EDDA: European Direct-Drive Architecture**, supported by the *H2020 Program (European Commission)*, Grant number: 870470, (100 k€).
Principal Investigator: Eduardo Ahedo.
Project Manager: Thales Alenia Space (France).
- 2019–2022 **MFOC, Madrid Flight on Chip**, supported by the *Community of Madrid*, Grant number: 49.520608.9.18, (332.4 k€).
Principal Investigator: Juan Llorens.
Project Manager: SENER Ingeniería y Sistemas.
- 2019–2021 **PROMETEO, Plasma Propulsion and Nuclear Fusion: innovating space transport**, supported by the *Community of Madrid*, Grant number: Y2018/NMT4750, (440.4 k€).
Principal Investigator: Eduardo Ahedo.
- 2019–2022 **MARTINLARA, Millimeter wave Array at Room Temperature for INstruments in Leo Altitude**, supported by the *Community of Madrid*, Grant number: P2018/NMT-4333, (165 k€).
Principal Investigator: Mario Merino.
- 2018–2020 **NanoStar, Collaborative network for the development of educational nanosatellites in Europe**, supported by the *EU Interreg-SUDOE VB Program*, Grant number: SOE2/P1/F0684, (310.5 k€).
Principal Investigator: Mario Merino.
Project Manager: Aersospace Valley (France).
- 2017–2020 **MINOTOR, Magnetic NOzzle thruster with elecTron cyclOtron Resonance**, supported by the *H2020 Program (European Commission)*, Grant number: 730028, (310 k€).
Principal Investigator: Mario Merino.
Project Manager: ONERA (France).
- 2017–2019 **PE3, Propulsores Electromagnéticos para la Exploración Espacial**, supported by the *Ministry of Economy and Competitiveness, National I+D plan, Spanish Government*, Grant number: ESP2016-75887-P, (228.4 k€).
Principal Investigators: Eduardo Ahedo, Pablo Fajardo.
- 2016–2020 **CHEOPS, Consortium for Hall Effect Orbital Propulsion System**, supported by the *H2020 Program (European Commission)*, Grant number: 730135, (360 k€).
Principal Investigator: Eduardo Ahedo.
Project Manager: SAFRAN-Snecma (France).
- 2013–2015 **Cámara de Ensayo de Propulsión Eléctrica**, supported by the *Ministry of Economy and Competitiveness, National program for scientific infrastructure and equipment, Spanish Government*, Grant number: UNC313-4E-1552, (547.5 k€).
Principal Investigators: Eduardo Ahedo, Pablo Fajardo.

- 2013–2016 **Propulsión Espacial por Plasma: Simulación y Experimentación**, supported by the Ministry of Economy and Competitiveness, National I+D plan, Spanish Government, Grant number: ESP2013-41052-P, (242 k€).
Principal Investigators: Eduardo Ahedo, Pablo Fajardo.
- 2013–2016 **LEOSWEEP, improving Low Earth Orbit Security With Enhanced Electric Propulsion**, supported by the European 7th Framework Program (European Commission), Grant number: 607457, (165 k€).
Principal Investigator: Eduardo Ahedo.
Project Manager: SENER Ingeniería y Sistemas.
- 2010–2013 **Propulsión Espacial por Plasma**, supported by the Ministry of Economy and Competitiveness, National I+D plan, Spanish Government, Grant number: AYA2010-16699, (70 k€).
Principal Investigator: Eduardo Ahedo.
- 2008–2010 **HPH.com, Helicon Plasma Hydrazine COmbined Micro**, supported by the European 7th Framework Program (European Commission), Grant number: 218862, (96 k€).
Principal Investigator: Eduardo Ahedo.
Project Manager: Università degli Studi di Padova (Italy).

Research contracts:

- 2019–2023 **UC3M-ISDEFE Space Chair**, supported by ISDEFE Ingeniería de Sistemas para la Defensa de España, S.A., (220 k€).
Principal Investigator: Pablo Fajardo.
- 2018–2020 **Improvements in Helicon Antenna Thruster RF-Plasma Discharge Coupling for its Evolution towards Space Application**, supported by ESA GSTP Program, Grant number: RFP/3-15534/18/NL/KML/va, (100 k€).
Principal Investigator: Pablo Fajardo.
- 2018–2020 **UC3M-SENER Research Chair**, supported by SENER Ingeniería y Sistemas, (60 k€).
Principal Investigator: Eduardo Ahedo.
- 2018–2019 **Faraday Probe for Helicon Plasma Thruster**, supported by ESA, (7.5 k€).
Principal Investigator: Jaume Navarro.
Project Manager: SENER Ingeniería y Sistemas.
- 2017 **Experimental campaign for the characterization and optimization of the HPT-05M Helicon Plasma Thruster prototype**, supported by SENER Ingeniería y Sistemas, (15 k€).
Principal Investigator: Jaume Navarro.
- 2016–2019 **Development of an advanced axisymmetric model of the full plasma discharge in the Helicon Plasma Thruster**, supported by Airbus Defence and Space (France), (90 k€).
Principal Investigator: Eduardo Ahedo.
- 2016–2018 **Technological prospective in the aerospace field**, supported by ISDEFE S.A., (specific framework contract), (80 k€).
Principal Investigator: Pablo Fajardo.
- 2016–2018 **MODEX: Model and experimental validation of spacecraft thruster interactions for electric propulsion thrusters plume**, supported by ESA, Contract number: 4000116180/15/NL/PS, (80 k€).
Principal Investigator: Eduardo Ahedo.
Project Manager: Airbus Defense and Space (France).

- 2016–2017 **Characterisation tests on Helicon Plasma Thruster**, supported by Airbus Defence and Space (France), (15 k€).
Principal Investigator: Pablo Fajardo.
- 2016 **Characterisation tests on Helicon Plasma Thruster**, supported by SENER, (13.5 k€).
Principal Investigator: Pablo Fajardo.
- 2015–2016 **Design and manufacturing of a RFCLP Langmuir Probe for the use in RF Generated Plasmas**, supported by ESA, Contract number: 5001017118, (12.5 k€).
Principal Investigator: Mario Merino.
Project Manager: SENER Ingeniería y Sistemas.
- 2013–2015 **HPT, Helicon Plasma Thrusters for Space Missions**, supported by ESA, Contract number: 4000107292/12/NL/CO, (63.5 k€).
Principal Investigator: Eduardo Ahedo.
Project Manager: SENER Ingeniería y Sistemas.
After the conclusion of the project, activity was continued within a joint venture with SENER for the development, construction and testing of the **HPT05 Helicon Plasma Thruster prototype**.
- 2013–2014 **IBSIOD, Ion Beam Shepherd In-Orbit Demonstrator**, supported by ESA, Contract number: 4000109292/13/NL/MV, (8 k€).
Principal Investigator: Eduardo Ahedo.
Project Manager: DEIMOS SPACE.
- 2012–2013 **Plasma detachment mechanisms in propulsive magnetic nozzles**, supported by the EOARD, USAF, Contract number: FA8655-12-1-2043, (30 k€).
Principal Investigator: Eduardo Ahedo.
- 2010–2011 **Magnetic nozzles for plasma thrusters: acceleration, thrust, and detachment mechanisms**, supported by the EOARD, USAF, Contract number: FA8655-10-1-3085, (25 k€).
Principal Investigator: Eduardo Ahedo.
- 2010–2011 **Ion Beam Shepherd for Contactless Debris Removal**, supported by ESA, Contract number: 4000101447/10/NL/CBi, (12.5 k€).
Principal Investigator: Claudio Bombardelli.

Research internships abroad:

- 2018 **Beihang University, China**, January (2 weeks), Research on improved plasma plume full-PIC boundary conditions for electrons, Prof. H. Tang research group.
- 2017 **Massachusetts Institute of Technology, USA**, June-August (3 months), Theoretical study of plasma waves near the electron cyclotron resonance, at the Plasma Science and Fusion Center, Prof. P. Bonoli research group.
- 2014 **University of California Los Angeles, USA**, June-August (3 months), Experimental plasma physics of cusp confinement for plasma space propulsion, at Prof. R. Wirz research group.
- 2012 **Stuttgart University, Germany**, June-August (3 months), Experimental investigation of a high-power, applied-field Magneto-plasma-dynamic thruster, at Institute of Space Systems (IRS).

Direction of PhD theses:

- 2021–present **Magnetic arch electrodeless plasma thruster experimental investigation**, doctorand: Célian Boyé, Universidad Carlos III de Madrid.
Thesis in progress.
- 2021–present **Multi-fluid modeling and simulation of advanced electrodeless plasma thrusters**, doctorand: Diego García, Universidad Carlos III de Madrid.
Thesis in progress.
- 2020–present **Development and characterization of Data-driven fast plasma diagnostics for Hall thruster research**, doctorand: Davide Maddaloni, Universidad Carlos III de Madrid.
Thesis in progress.
- 2019–present **Modeling the wave-plasma interaction in space plasma thrusters**, doctorand: Pedro Jiménez, Universidad Carlos III de Madrid.
Thesis in progress.
- 2019–present **Design and construction of an electrodeless plasma thruster for space applications**, doctorand: Marco Inchingolo, Universidad Carlos III de Madrid.
Thesis in progress.
- 2019–present **Design and development of a μ -pulsed plasma thruster**, doctorand: Scherezade Barquero, Universidad Carlos III de Madrid.
Thesis in progress.
- 2016–present **Modeling the plasma discharge in an electron-cyclotron-resonance thruster**, doctorand: Álvaro Sánchez, Universidad Carlos III de Madrid.
Thesis in progress.
- 2014–2017 **Analysis of the expansion of a plasma thruster plume into vacuum**, doctorand: Filippo Cichocki, Universidad Carlos III de Madrid.
Awarded: *Cum Laude*; Ministry's International Mention; and the UC3M Extraordinary PhD Thesis Award.
- 2013–2017 **Modeling of physical processes in radio-frequency plasmas**, doctorand: Bin Tian, Universidad Carlos III de Madrid.

Supervision of incoming visitors and students:

- 2020–present **Yonis Legrand**, *TU Delft, The Netherlands*, 6 month MSc thesis internship under the ERASMUS+ placement program.
Work: Implementation of a transverse model for a micro-PPT plasma thruster (ongoing), Universidad Carlos III de Madrid.
- 2016–2017 **Min Li**, *Beihang University, China*, 6 month PhD research internship funded by Chinese Government scholarship.
Work: Particle-in-cell analysis of the electron demagnetization process in the far region of propulsive magnetic nozzles, Universidad Carlos III de Madrid.
- 2016–2017 **Javier Mauriño-Alperovich**, *Imperial College, UK*, 6 month MSc internship.
Work: Kinetic modeling of collisionless electron cooling in electric propulsion plasma plumes, Universidad Carlos III de Madrid.
- 2015–2016 **Mick Wijnen**, *TU Delft, The Netherlands*, 4 month internship and 6 month MSc thesis under the ERASMUS+ placement Program.
Work: Development of diagnostic system for EP test facility and characterization of a Helicon plasma thruster prototype, Universidad Carlos III de Madrid.
- 2016 **Aurélien Proux**, *ENSTA-ParisTECH, France*, 3 month MSc internship under the ERASMUS+ placement Program.
Work: Kinetic modeling of expanding plasma plumes into vacuum, Universidad Carlos III de Madrid.

- 2016 **Saul Rindt**, *TU Eindhoven, The Netherlands*, 3 month MSc internship under the ERASMUS+ placement Program.
Work: ECR plasma heating in space thrusters, Universidad Carlos III de Madrid.
- 2015 **Simon Peterschmitt**, *ENSTA-ParisTECH, France*, 3 month MSc internship.
Work: Toward a wave-plasma model of the electron-cyclotron resonance (ECR) plasma thruster, Universidad Carlos III de Madrid.

Publications in Peer-Reviewed Journals and Books

- 1 Ahedo, E. and Merino, M., "Two-dimensional supersonic plasma acceleration in a magnetic nozzle," *Physics of Plasmas*, Vol. 17, No. 7, 2010, pp. 073501.
- 2 Ahedo, E. and Merino, M., "On plasma detachment in propulsive magnetic nozzles," *Physics of Plasmas*, Vol. 18, No. 5, 2011, pp. 053504.
- 3 Merino, M. and Ahedo, E., "Simulation of plasma flows in divergent magnetic nozzles," *IEEE Transactions on Plasma Science*, Vol. 39, No. 11, 2011, pp. 2938–2939.
- 4 Ahedo, E. and Merino, M., "Two-dimensional plasma expansion in a magnetic nozzle: separation due to electron inertia," *Physics of Plasmas*, Vol. 19, No. 8, 2012, pp. 083501.
- 5 Bombardelli, C., Urrutxua, H., Merino, M., Ahedo, E., and Peláez, J., "Relative Dynamics and Control of an Ion Beam Shepherd Satellite," *Spaceflight mechanics 2012*, edited by J. V. McAdams, D. P. McKinley, M. M. Berry, and K. L. Jenkins, Vol. 143 of *Advances in the Astronautical Sciences*, Univelt, 2012, pp. 2145–2158.
- 6 Bombardelli, C., Urrutxua, H., Merino, M., Ahedo, E., and Peláez, J., "The ion beam shepherd: A new concept for asteroid deflection," *Acta Astronautica*, Vol. 90, No. 1, 2013, pp. 98 – 102.
- 7 Merino, M. and Ahedo, E., "Two-dimensional quasi-double-layers in two-electron-temperature, current-free plasmas," *Physics of Plasmas*, Vol. 20, No. 2, 2013, pp. 023502.
- 8 Merino, M., Ahedo, E., Bombardelli, C., Urrutxua, H., and Peláez, J., "Ion Beam Shepherd satellite for Space Debris Removal," *Progress in Propulsion Physics*, edited by L. T. DeLuca, C. Bonnal, O. J. Haidn, and S. M. Frolov, Vol. IV of *EUCASS Advances in Aerospace Sciences*, chap. 8, EDP Sciences, Les Ulis, France, 2013, pp. 789–802.
- 9 Merino, M. and Ahedo, E., "Plasma detachment in a propulsive magnetic nozzle via ion demagnetization," *Plasma Sources Science and Technology*, Vol. 23, No. 3, 2014, pp. 032001.
- 10 Merino, M. and Ahedo, E., "Influence of Electron and Ion Thermodynamics on the Magnetic Nozzle Plasma Expansion," *IEEE Transactions on Plasma Science*, Vol. 43, No. 1, Jan 2015, pp. 244–251.
- 11 Merino, M., Cichocki, F., and Ahedo, E., "Collisionless Plasma thruster plume expansion model," *Plasma Sources Science and Technology*, Vol. 24, No. 3, 2015, pp. 035006.
- 12 Alpatov, A., Cichocki, F., Fokov, A., Khoroshylov, S., Merino, M., and Zakrzhevskii, A., "Determination of the force transmitted by an ion thruster plasma plume to an orbital object," *Acta Astronautica*, Vol. 119, 2016, pp. 241–251.
- 13 Merino, M. and Ahedo, E., "Fully magnetized plasma flow in a magnetic nozzle," *Physics of Plasmas*, Vol. 23, No. 2, 2016, pp. 023506.

- 14 Merino, M. and Ahedo, E., "Effect of the plasma-induced magnetic field on a magnetic nozzle," *Plasma Sources Science and Technology*, Vol. 25, No. 4, 2016, pp. 045012.
- 15 Merino, M. and Ahedo, E., "Magnetic Nozzles for Space Plasma Thrusters," *Encyclopedia of Plasma Technology*, edited by J. L. Shohet, Vol. 2, Taylor and Francis, 2016, pp. 1329–1351.
- 16 Cichocki, F., Merino, M., Ahedo, E., Smirnova, M., Mingo, A., and Dobkevicius, M., "Electric Propulsion Subsystem Optimization for "Ion Beam Shepherd" Missions," *Journal of Propulsion and Power*, Vol. 33, No. 2, 2017, pp. 370–378.
- 17 Merino, M. and Ahedo, E., "Contactless steering of a plasma jet with a 3D magnetic nozzle," *Plasma Sources Science and Technology*, Vol. 26, No. 9, 2017, pp. 095001.
- 18 Cichocki, F., Domínguez-Vázquez, A., Merino, M., and Ahedo, E., "Hybrid 3D model for the interaction of plasma thruster plumes with nearby objects," *Plasma Sources Science and Technology*, Vol. 26, No. 12, 2017, pp. 125008.
- 19 Giono, G., Gudmundsson, J., Ivchenko, N., Mazouffre, S., Dannenmayer, K., Popelier, L., Loubere, D., Merino, M., and Olentsenko, G., "Non-Maxwellian Electron Energy Probability Functions in the plume of a SPT-100 Hall thruster," *Plasma Sources Science and Technology*, Vol. 27, No. 1, 2018, pp. 015006.
- 20 Cichocki, F., Merino, M., and Ahedo, E., "Spacecraft-plasma-debris interaction in an ion beam shepherd mission," *Acta Astronautica*, Vol. 146, 2018, pp. 216–227.
- 21 Merino, M., Mauriño, J., and Ahedo, E., "Kinetic electron model for plasma thruster plumes," *Plasma Sources Science and Technology*, Vol. 27, No. 3, 2018, pp. 035013.
- 22 Ramos, J., Merino, M., and Ahedo, E., "Three dimensional fluid-kinetic model of a magnetically guided plasma jet," *Physics of Plasmas*, Vol. 25, No. 6, 2018, pp. 061206.
- 23 Domínguez-Vázquez, A., Cichocki, F., Merino, M., Fajardo, P., and Ahedo, E., "Axisymmetric plasma plume characterization with 2D and 3D particle codes," *Plasma Sources Science and Technology*, Vol. 27, No. 10, 2018, pp. 104009.
- 24 Tian, B., Merino, M., and Ahedo, E., "Two-dimensional plasma-wave interaction in an helicon plasma thruster with magnetic nozzle," *Plasma Sources Science and Technology*, Vol. 27, No. 11, 2018, pp. 114003.
- 25 Li, M., Merino, M., Ahedo, E., and Tang, H., "On electron boundary conditions in PIC plasma thruster plume simulations," *Plasma Sources Science and Technology*, Vol. 28, No. 03, 2019, pp. 034004.
- 26 Correyero, S., Merino, M., Elias, P.-Q., Jarrige, J., Packan, D., and Ahedo, E., "Characterization of diamagnetism inside an ECR thruster with a diamagnetic loop," *Physics of Plasmas*, Vol. 26, No. 5, 2019, pp. 053511.
- 27 Ahedo, E., Correyero, S., Navarro, J., and Merino, M., "Macroscopic and parametric study of a kinetic plasma expansion in a paraxial magnetic nozzle," *Plasma Sources Science and Technology*, Vol. 29, No. 4, 2020, pp. 045017.
- 28 Merino, M., Fajardo, P., Giono, G., Gudmundsson, J. T., Ivchenko, N., Mazouffre, S., Loubere, D., and Dannenmayer, K., "Collisionless electron cooling in a plasma thruster plume:

experimental validation of a kinetic model," *Plasma Sources Science and Technology*, Vol. 29, No. 3, 2020, pp. 035029.

- 29 Cichocki, F., Merino, M., and Ahedo, E., "Three-dimensional geomagnetic field effects on a plasma thruster plume expansion," *Acta Astronautica*, Vol. 175, 2020, pp. 190 – 203.
- 30 Takahashi, K., Charles, C., Boswell, R. W., Takao, Y., Fruchtman, A., Navarro-Cavallé, J., and Merino, M., "Commentary: On helicon thrusters: Will they ever fly?" *Frontiers in Physics*, Vol. 8, 2020, pp. 277.
- 31 Kaganovich, I. D., Smolyakov, A., Raiteses, Y., Ahedo, E., Mikellides, I. G., Jorns, B., Taccogna, F., Gueroult, R., Tsikata, S., Bourdon, A., Boeuf, J.-P., Keidar, M., Powis, A. T., Merino, M., Cappelli, M., Hara, K., Carlsson, J. A., Fisch, N. J., Chabert, P., Schweigert, I., Lafleur, T., Matyash, K., Khrabrov, A. V., Boswell, R. W., and Fruchtman, A., "Perspectives on Physics of ExB Discharges Relevant to Plasma Propulsion and Similar Technologies," *Physics of Plasmas*, Vol. 27, No. 12, 2020, pp. 120601.
- 32 Sánchez-Villar, A., Zhou, J., Merino, M., and Ahedo, E., "Coupled plasma transport and electromagnetic wave simulation of an ECR thruster," *Plasma Sources Science and Technology*, submitted for publication.

Peer-reviewing activities:

Frequent peer-reviewer in *Physical Review Letters (APS)*, *Physics of Plasmas (AIP)*, *Plasma Sources Science and Technology (IOP)*, *IEEE Transaction on Plasma Science (IEEE)*, and *Journal of Physics D: Applied Physics (IOP)*.

Patents

- 1 Merino, M. and Ahedo, E., "Sistema sin partes móviles ni electrodos y procedimiento para vectorizar el empuje en motores espaciales de plasma," 2013, Spanish Patent Office, Patent no. ES2540167.
- 2 Merino, M., "Motor espacial de plasma sin electrodos con geometría en U," 2019, PCT patent, Spanish Patent Office, Patent no. ES2733773.

Open-source simulation codes

Codes are hosted on GitHub (<https://github.com/mariomerinomartinez>).

- 1 Mario Merino. DIMAGNO code: Divergent Magnetic Nozzle plasma flow solver, DOI: 10.5281/zenodo.1257295, 2017. doi:10.5281/zenodo.1257295.
- 2 Mario Merino. ANAKIN code: Aerospace eNginer's Assistant for Kinematics, Inertia and dyNamics, DOI: 10.5281/zenodo.2533336, 2018. doi:10.5281/zenodo.2533336.
- 3 Mario Merino. FUMAGNO code: Fully-magnetized magnetic nozzle simulator, DOI: 10.5281/zenodo.593787, 2017. doi:10.5281/zenodo.593787.
- 4 Mario Merino and Javier Mauriño. AKILES code: Advanced Kinetic Iterative pLasma Expansion Solver 2D, DOI: 10.5281/zenodo.1098432, 2017. doi:10.5281/zenodo.1098432.

Publications in Conference Proceedings

- 1 Ahedo, E. and Merino, M., "Two-dimensional plasma acceleration in a divergent magnetic nozzle," *45th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA 2009-5361, American Institute of Aeronautics and Astronautics, 2009.
- 2 Ahedo, E. and Merino, M., "Acceleration of a focused plasma jet in a divergent magnetic nozzle," *31st International Electric Propulsion Conference*, No. IEPC-2009-002, Electric Rocket Propulsion Society, 2009, pp. 1–10.
- 3 Merino, M. and Ahedo, E., "Two-dimensional magnetic nozzle acceleration of a two-electron component plasma," *2nd Space Propulsion Conference*, No. SP2010-1841391, Association Aéronautique et Astronautique de France, 2010.
- 4 Ahedo, E. and Merino, M., "Preliminary assessment of detachment in a plasma thruster magnetic nozzle," *46th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA 2010-6613, American Institute of Aeronautics and Astronautics, Nashville, TN, 2010.
- 5 Bombardelli, C., Urrutxua, H., Merino, M., Ahedo, E., Peláez, J., and Olympio, J., "Dynamics of Ion-beam-propelled space debris," *22nd International Symposium on Space Flight Dynamics*, 2011.
- 6 Merino, M. and Ahedo, E., "Plasma detachment mechanisms in a magnetic nozzle," *47th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2011-5999, American Institute of Aeronautics and Astronautics, 2011.
- 7 Merino, M., Ahedo, E., Bombardelli, C., Urrutxua, H., Peláez, J., and Summerer, L., "Space Debris Removal with an Ion Beam Shepherd Satellite: target-plasma interaction," *47th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2011-6142, American Institute of Aeronautics and Astronautics, 2011.
- 8 Merino, M., Ahedo, E., Bombardelli, C., Urrutxua, H., and Peláez, J., "Hypersonic Plasma Plume Expansion in Space," *32nd International Electric Propulsion Conference*, No. IEPC-2011-086, Electric Rocket Propulsion Society, 2011.
- 9 Ahedo, E. and Merino, M., "On electron inertia and current ambipolarity in magnetic nozzle models," *32nd International Electric Propulsion Conference*, No. IEPC-2011-050, Electric Rocket Propulsion Society, 2011.
- 10 Merino, M., Ahedo, E., Bombardelli, C., Urrutxua, H., and Peláez, J., "Ion Beam Shepherd Satellite for Space Debris Removal," *4th European Conference for Aerospace Sciences*, EUCASS, 2011.
- 11 Merino, M., "2D plasma flow in a magnetic nozzle with a bi-modal Electron Energy Distribution Function," *50th AIAA Aerospace Sciences Meeting*, No. AIAA 2012-0139, American Institute of Aeronautics and Astronautics, 2012.
- 12 Merino, M. and Ahedo, E., "Magnetic Nozzle Far-Field Simulation," *48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2012-3843, American Institute of Aeronautics and Astronautics, 2012.
- 13 Navarro-Cavallé, J., Merino, M., and Ahedo, E., "Two-Fluid and PIC-Fluid Code Comparison of the Plasma Plume in a Magnetic Nozzle," *48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2012-3840, American Institute of Aeronautics and Astronautics, 2012.

- 14 Navarro-Cavallé, J., Merino, M., and Ahedo, E., "A fluid dynamic performance model of a helicon thruster," *48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2012-3955, American Institute of Aeronautics and Astronautics, 2012.
- 15 Dannenmayer, K., Mazouffre, S., Merino, M., and Ahedo, E., "Hall Effect Thruster Plasma Plume Characterization with Probe Measurements and Self-Similar Fluid Models," *48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2012-4117, American Institute of Aeronautics and Astronautics, Atlanta, Georgia, July 30 - August 1, 2012.
- 16 Boxberger, A., Bambach, P., Herdrich, G., Fasoulas, S., Merino, M., and Ahedo, E., "Experimental Investigation of Applied-Field Magnetoplasmadynamic Thrusters at Institute of Space Systems," *48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2012-4012, American Institute of Aeronautics and Astronautics, 2012.
- 17 Merino, M. and Ahedo, E., "Influence of Electron and Ion Thermodynamics on the Magnetic Nozzle Plasma Expansion," *33rd International Electric Propulsion Conference*, No. IEPC-2013-247, Electric Rocket Propulsion Society, 2013.
- 18 Navarro-Cavallé, J., Ahedo, E., Merino, M., Gómez, V., and Ruiz, M., "Helicon Plasma Thrusters: prototypes and advances on modeling," *33rd International Electric Propulsion Conference*, No. IEPC-2013-285, Electric Rocket Propulsion Society, 2013.
- 19 Navarro-Cavallé, J., Ahedo, E., Merino, M., Urdampilleta, I., Ruiz, M., and González-del Amo, J., "Assessment of helicon plasma thruster technology for space missions," *Space Propulsion Conference 2014*, Association Aéronautique et Astronautique de France, 2014.
- 20 Ruiz, M., Urdampilleta, I., Bombardelli, C., Ahedo, E., Merino, M., and Cichocki, F., "The FP7 LEOSWEEP project: Improving low earth orbit security with enhanced electric propulsion," *Space Propulsion Conference 2014*, No. 2014-2980908, Association Aéronautique et Astronautique de France, Cologne, Germany, May 19-22, 2014.
- 21 Merino, M., Cichocki, F., and Ahedo, E., "Plasma Thruster Beam Expansion and Impingement in Space Debris," *13th Spacecraft Charging Technology Conference*, No. 253, NASA's Jet Propulsion Laboratory, 2014.
- 22 Navarro-Cavallé, J., Merino, M., Ahedo, E., Ruiz, M., and Sánchez, V., "Design of Helicon Plasma Thruster subsystems," *50th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2014-3699, American Institute of Aeronautics and Astronautics, 2014.
- 23 Cichocki, F., Merino, M., and Ahedo, E., "Modeling and simulation of EP Plasma Plume Expansion into Vacuum," *50th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2014-3828, American Institute of Aeronautics and Astronautics, Cleveland, Ohio, July 28-30, 2014.
- 24 Cichocki, F., Merino, M., Ahedo, E., Feili, D., and Ruiz, M., "Electric Propulsion Subsystem Optimization for "Ion Beam Shepherd" missions," *34th International Electric Propulsion Conference*, No. IEPC-2015-420, Electric Rocket Propulsion Society, Hyogo-Kobe, Japan, July 6-10, 2015.
- 25 Cichocki, F., Ahedo, M. M., and Wang, J., "Fluid vs PIC Modeling of a Plasma Plume Expansion," *34th International Electric Propulsion Conference*, No. IEPC-2015-35, Electric Rocket Propulsion Society, Hyogo-Kobe, Japan, July 6-10, 2015.

- 26 Feili, D., Ruiz, M., Ahedo, E., Merino, M., Smirnova, M., and Dobkevicius, M., "Impulse Transfer Thruster for an Ion Beam Shepherd Mission," *34th International Electric Propulsion Conference*, No. IEPC-2015-382, Electric Rocket Propulsion Society, Hyogo-Kobe, Japan, July 6-10, 2015.
- 27 Merino, M., Navarro-Cavallé, J., Casado, S., Gómez, E. A., Ruiz, M., Bosch, E., and González-del Amo, J., "Design and development of a 1 kW-class helicon antenna thruster," *34th International Electric Propulsion Conference*, No. IEPC-2015-297, Electric Rocket Propulsion Society, Hyogo-Kobe, Japan, July 6-10, 2015.
- 28 Merino, M. and Ahedo, E., "Towards thrust vector control with a 3D steerable magnetic nozzle," *34th International Electric Propulsion Conference*, No. IEPC-2015-414, Electric Rocket Propulsion Society, Hyogo-Kobe, Japan, July 6-10, 2015.
- 29 Merino, M. and Ahedo, E., "Modelling the expansion of magnetized plasma jets in electric propulsion," *32nd International Conference on Plasmas and Ionized Gases*, No. TL19, European Physical Society, Iasi, Romania, 2015.
- 30 Merino, M., Navarro-Cavallé, J., Ahedo, E., Gómez, V., Sánchez, V., Ruiz, M., Dannenmayer, K., Bosch, E., and González, J., "Maiden tests of the HPT05 Helicon plasma thruster prototype," *Space Propulsion Conference 2016*, Association Aéronautique et Astronautique de France, Rome, Italy, 2016, p. 3125014.
- 31 Cichocki, F., Rafalskyi, D., Aanesland, A., and Merino, M., "The plume neutralization process of the Pegases thruster," *Space Propulsion Conference 2016*, No. 3124967, Association Aéronautique et Astronautique de France, Rome, Italy, May 2-6, 2016.
- 32 Cichocki, F., Domínguez-Vázquez, A., and Ahedo, E., "A 3D hybrid code to study electric thruster plumes," *Space Propulsion Conference 2016*, Association Aéronautique et Astronautique de France, Rome, Italy, 2016, p. 3124968.
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- 34 Ahedo, E. and Merino, M., "Physics of Magnetic Nozzles for plasma thrusters," *VKI Lecture Series: Electric Propulsion Systems: from recent research developments to industrial space applications*, No. STO-AVT-263, Von Karman Institute, Von Karman Institute, Belgium, 2016.
- 35 Tian, B., Ahedo, E., and Merino, M., "Development and Validation of a 2D wave-plasma code for helicon plasma thrusters," *Space Propulsion Conference 2016*, Association Aéronautique et Astronautique de France, Rome, Italy, 2016, p. 3124913.
- 36 Merino, M., Proux, A., Fajardo, P., and Ahedo, E., "Collisionless electron cooling in unmagnetized plasma thruster plumes," *52nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA 2016-5037, American Institute of Aeronautics and Astronautics, Salt Lake City, UT, 2016.
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 - 43 Li, M., Merino, M., Ahedo, E., Ren, J., and Tang, H., "Full-pic code validation and comparison against fluid models on plasma plume expansion," *35th International Electric Propulsion Conference*, No. IEPC-2017-230, Electric Rocket Propulsion Society, Atlanta, GA, 2017.
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 - 47 Sanjurjo-Rivo, M., Merino, M., Cichocki, F., Pérez-Grande, D., Morante, D., Sánchez-Arriaga, G., Soler, M., Chen, X., and Ahedo, E., "The Conquest of Space: a MOOC and a

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- 48 Merino, M., García-Souto, J. A., Pradels, G., Daveran, F., Ghiotto, A., Kerherve, E., Escudier, B., Gateau, T., Roche, N., Bernard, M., Dusseau, L., Fontán, E., Alonso, G., Guerman, A., Charrua-Santos, F., and da Costa Campos, L. B., "NanoStar University Network: Hands-on higher Aerospace Education through Nanosatellite Student Challenges," *2nd Symposium on Space Educational Activities*, Association Aéronautique et Astronautique de France, Budapest, Hungary, 2018.
 - 49 Cichocki, F., Merino, M., and Ahedo, E., "A 3D electron fluid model to study magnetic field effects on an expanding plasma thruster plume," *Space Propulsion Conference 2018*, 00295, Association Aéronautique et Astronautique de France, Seville, Spain, May 14-18, 2018.
 - 50 Sánchez-Villar, A. and Merino, M., "Advances in Wave-Plasma Modelling in ECR Thrusters," *Space Propulsion Conference 2018*, No. 00346, Association Aéronautique et Astronautique de France, Seville, Spain, 2018.
 - 51 Merino, M., Mauriño, J., and Ahedo, E., "Kinetic electron response in a rarefied plasma jet expanding into vacuum (invited talk)," *24th Europhysics Conference on Atomic and Molecular Physics of Ionized Gases*, European Physical Society, Glasgow, UK, 2018.
 - 52 Ahedo, E., Fajardo, P., Merino, M., Navarro-Cavallé, J., Sánchez-Villar, A., Wijnen, M., and Zhou, J., "Helicon and ECR plasma sources for space propulsion: simulation and testing," *2019 International Conference on Electromagnetics in Advanced Applications (ICEAA)*, 2019, pp. 0788–0793.
 - 53 Packan, D., Elias, P.-Q., Jarrige, J., Vialis, T., Correyero, S., Peterschmitt, S., Porto-Hernandez, J., Merino, M., Sánchez-Villar, A., Ahedo, E., Peyresoubes, G., Thorinius, A., Denis, S., Holste, K., Klar, P., Scharmann, S., Zorn, J., Bekemans, M., Scalais, T., Bourguignon, E., Zurbach, S., Azais, P., Habbassi, I., Mares, M., and Hoque, A., "H2020 MINOTOR: Magnetic nozzle electron cyclotron resonance thruster," *36th International Electric Propulsion Conference*, No. IEPC-2019-875, Electric Rocket Propulsion Society, Vienna, Austria, 2019.
 - 54 Correyero, S., Merino, M., and Ahedo, E., "Effect of the initial VDFs in magnetic nozzle expansions," *36th International Electric Propulsion Conference*, No. IEPC-2019-818, Electric Rocket Propulsion Society, Vienna, Austria, 2019.
 - 55 Sánchez-Villar, A., Zhou, J., Merino, M., and Ahedo, E., "PIC/fluid/wave Simulations of the Plasma Discharge in an ECR Plasma Thruster," *36th International Electric Propulsion Conference*, No. IEPC-2019-633, Electric Rocket Propulsion Society, Vienna, Austria, 2019.
 - 56 Cichocki, F., Domínguez-Vázquez, A., Merino, M., and Ahedo, E., "3D simulations of a magnetized Hall Effect thruster plume," *36th International Electric Propulsion Conference*, No. IEPC-2019-460, Electric Rocket Propulsion Society, Vienna, Austria, 2019.
 - 57 Zhou, J., Jiménez, P., Merino, M., Fajardo, P., and Ahedo, E., "Numerical Simulations of the Plasma Discharge in a Helicon Plasma Thruster," *36th International Electric Propulsion Conference*, No. IEPC-2019-330, Electric Rocket Propulsion Society, Vienna, Austria, 2019.

- 58 Perales, J., Cichocki, F., Merino, M., and Ahedo, E., "Studying the formation and neutralization of an ion thruster plume with EP2PLUS," *36th International Electric Propulsion Conference*, No. IEPC-2019-491, Electric Rocket Propulsion Society, Vienna, Austria, 2019.
- 59 Nuez, J., Merino, M., and Ahedo, E., "Fluid-kinetic propulsive magnetic nozzle model in the fully magnetized limit," *36th International Electric Propulsion Conference*, No. IEPC-2019-254, Electric Rocket Propulsion Society, Vienna, Austria, 2019.
- 60 Sarasola, S., Álvaro Arroyo, C., Gómez, R., González, V., Renieblas, M., Ribera, V., Prado, P., Melgar, I., Cacciatore, F., Cichocki, F., Merino, M., Sanjurjo, M., Mendoza-Bárceñas, M., and Prieto-Meléndez, R., "Diseño preliminar de la misión espacial TEPEU-1," *2020 Congreso Nacional de Actividades Espaciales (CONACES)*, Mexico, 2020.

Other Presentations in Conferences

- 1 Merino, M. and Ahedo, E., "2D plasma flow in Magnetic Nozzles for Propulsion and Processing applications," *20th European Conference on the Atomic and Molecular Physics of Ionized Gases*, Belgrade Institute of Physics, Belgrade, Serbia, 2010.
- 2 Merino, M. and Ahedo, E., "Detachment mechanisms in a magnetic nozzle for plasma propulsion," *63rd Gaseous Electronics Conference and 7th International Conference on Reactive Plasmas*, No. DTP-085, 2010.
- 3 Merino, M., Martínez, I., Navarro-Cavallé, J., and Ahedo, E., "Toberas Magnéticas: un elemento propulsor de futuros motores de plasma," *5th Spanish Space Student Congress*, Laboratorio para Experimentación en Espacio y Microgravedad, Madrid, Spain, 2010.
- 4 Merino, M., "La basura espacial: una estrategia de eliminación activa mediante propulsión eléctrica inversa y tethers electrodinámicos," *5th Spanish Space Student Congress*, Laboratorio para Experimentación en Espacio y Microgravedad, Madrid, Spain, 2010.
- 5 Merino, M., "Toberas magnéticas para motores espaciales de plasma," *9th Certamen Universitario Arquímedes de Introducción a la Investigación Científica*, Government of Spain, 2011.
- 6 Merino, M., "Magnetic Nozzles for Plasma Space Propulsion," *Aerospace Testing 2010*, Aerospace Testing, 2010.
- 7 Merino, M. and Ahedo, E., "Toberas magnéticas en futuros motores espaciales de plasma," *XXXIII Reunión Bienal de la RSEF*, Real Sociedad Española de Física, 2011.
- 8 Merino, M., "New electric propulsion technologies investigation by simulation," *18th SPINE Meeting and Workshop*, SPIS/SPINE Community, ESA, 2012.
- 9 Navarro-Cavallé, J., Merino, M., and Ahedo, E., "Plasma Structure Inside and Outside a Helicon Thruster," *39th IEEE International Conference on Plasma Science*, 2012.
- 10 Merino, M. and Ahedo, E., "Advanced Plasma Propulsion with Magnetic Nozzles: Plasma detachment," *63th International Astronautical Congress*, International Astronautical Federation, 2012.
- 11 Merino, M., "Helicon plasma thruster prototypes and modelling status," *International Conference on Phenomena in Ionized Gases*, 2013.

- 12 Merino, M., "Key Processes in Plasma Acceleration and Detachment in a Magnetic Nozzle for Advanced Plasma Thrusters," *31st International Conference on Plasmas and Ionized Gases*, 2013.
- 13 Merino, M., "NOMADS and EP2PLUS: advanced hybrid codes for Hall thrusters, plasma plumes, and S/C interaction," *EPIC Workshop, Brussels*, 2014.
- 14 Merino, M., "2D DIMAGNO and HELWAVE2 simulators for Magnetic Nozzles and Helicon Antenna Sources," *EPIC Workshop, Brussels*, 2014.
- 15 Merino, M., "Non-mechanic thrust pointing system with steerable magnetic nozzle," *EPIC Workshop, Brussels*, 2014.
- 16 Alpatov, A., Cichocki, F., Fokov, A., Khoroshylov, S., Merino, M., and Zakrzhevskii, A., "Calculation of the Impact from plume of ion thruster to orbital debris," *5th International Conference on Space Technologies: Present and Future*, Dnepropetrovsk, Ukraine, 2015.
- 17 Alpatov, A., Cichocki, F., Fokov, A., Khoroshylov, S., Merino, M., and Zakrzhevskii, A., "Algorithm for determination of force transmitted by plume of ion thruster to orbital object using photo camera," *66th International Astronautical Congress*, No. IAC-15,A6,5,5,x27732, International Astronautical Federation, Jerusalem, Israel, 2015.
- 18 Merino, M., Ahedo, E., and Fajardo, P., "Development of physical models of electron cooling in collisionless plasma thruster plumes," *22nd SPINE Meeting and Workshop*, SPIS/SPINE Community, ESA, 2016.
- 19 Domínguez-Vázquez, A., Cichocki, F., Pérez-Grande, D., Merino, M., Fajardo, P., and Ahedo, E., "Hybrid PIC-fluid simulation of plasma thrusters and their plumes," *VKI Lecture Series: Electric Propulsion Systems: from recent research developments to industrial space applications*, No. STO-AVT-263, Von Karman Institute, Von Karman Institute, Belgium, 2016.
- 20 Cichocki, F., Domínguez-Vázquez, A., Pérez-Grande, D., Merino, M., Ahedo, E., and Fajardo, P., "Hybrid particle codes for electric propulsion," *14th Spacecraft Charging Technology Conference*, 2016.
- 21 Merino, M., Fajardo, P., Navarro-Cavallé, J., Chen, X., Babou, Y., and Ahedo, E., "Characteristics and capabilities of the new EP2 plasma propulsion laboratory," *Space Propulsion Conference 2016*, 2016.
- 22 Merino, M. and Ahedo, E., "Modeling magnetized plasma jets in electric propulsion," *International Workshop on Ion Propulsion and accelerator industrial applications*, No. IPAIA-2017-24, CNR, CNR Bari, Italy, 2017.
- 23 Merino, M., Navarro-Cavallé, J., Cichocki, F., Domínguez-Vázquez, A., Wijnen, M., Fajardo, P., and Ahedo, E., "Micro-Propulsion plasma plume measurement and simulation," *2nd International Conference on Micropropulsion and CubeSats*, Singapore, 2018.
- 24 Merino, M., Ahedo, E., Navarro-Cavallé, J., Fajardo, P., and Sánchez-Arriaga, G., "Magnetic nozzles," *EPIC workshop*, London, UK, 2018.
- 25 Cichocki, F., Merino, M., Ahedo, E., Catalán, J. M., and Domínguez-Vázquez, A., "Application of EP2PLUS 3D code to plasma thruster plumes and discharges," *EPIC workshop*, London, UK, 2018.

- 26 Domínguez-Vázquez, A., Pérez-Grande, D., Sánchez-Villar, A., Tian, B., Zhou, J., Fajardo, P., Merino, M., and Ahedo, E., "HYPHEN, a multi-thruster simulation platform," *EPIC workshop*, London, UK, 2018.
- 27 Merino, M., Cichocki, F., Ahedo, E., Catalán, J. M., Domínguez-Vázquez, A., and Fajardo, P., "Electron modeling in hybrid plasma thruster plume simulations," *25th SPINE Meeting and Workshop*, SPIS/SPINE Community, ESA, Noordwijk, Netherlands, 2018.
- 28 Merino, M., Álvaro Sánchez, Domínguez, A., Bello, E., Jiménez, P., Inchingolo, M., Navarro, J., Cichocki, F., Fajardo, P., Ahedo, E., Hidalgo, C., van Milligen, B., Tabarés, F., Calvo, I., Velasco, J., Álvaro Cappa, and de la Cal, E., "Synergies between space plasma propulsion and magnetic confinement plasma fusion: PROMETEO project," *XXXVII Reunión Bienal de la Real Sociedad Española de Física*, RSEF, Zaragoza, 2019.

Invited talks

- 2020-01-20 **The future of electric space propulsion: modeling and testing of the next-generation of plasma thrusters**, *INP-EINSEIRB-MATMECA, Bordeaux, France*, Invited lecture.
- 2019-03-23 **Why curiosity will make us conquer space**, *TEDx Chamberí, Madrid*, (Por qué la curiosidad nos hará conquistar el espacio).
- 2018-07-20 **Kinetic electron response in a rarified plasma jet expanding into vacuum**, *ES-CAMPIG 2018 conference, Glasgow, UK*, invited lecture.
- 2018-06-11 **Teaching Innovation days. How should university education be in the XXI century?**, *Universidad Carlos III de Madrid*, round table.
- 2018-04-19 **Modeling and testing of space plasma thrusters at EP2 research group**, *FEUP, Universidade do Porto, Porto, Portugal*, invited seminar.
- 2018-01-03 **Magnetic nozzles and electrodeless plasma thrusters**, *Beihang University of Aeronautics and Astronautics, Beijing, China*, invited seminar.
- 2017-03-03 **Modeling magnetized plasma jets in electric propulsion**, *IPAIA 2017 International Workshop, CNR Bari, Italy*, invited talk.
- 2017-01-26 **Modeling the physics of plasma thruster plumes in electric propulsion**, *ESAC, ESA, Spain*, invited seminar.
- 2016-10-11 **Modeling the expansion of plasma thruster plumes in space**, *Southampton University, UK*, invited seminar.
- 2016-09-08 **Round table: "E-learning, distance education: the future of university?" (E-learning y educación a distancia, ¿el futuro de la universidad?)**, *part of the 2-day course "Las Tecnologías de la Información y la Comunicación en la Universidad del siglo XXI"*, organized by the NPO "La Facultad Invisible", Universidad Internacional Menéndez Pelayo.
- 2016-05-26 **EP2 space plasma propulsion: codes and models**, *Ernst-Moritz-Arndt-Universität Greifswald, Germany*, invited seminar.
- 2015-07-30 **Modeling the expansion of magnetized plasma jets in electric propulsion**, *32nd ICPIG, Iași, Romania*, invited lecture.

Teaching activity

Aerospace engineering courses:

Average student survey grade on teaching: 4.4/5.

- 2019–present **“Spacecraft Predesign”**, *MSc in Space Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2019–present **“Complements of Aerospace Engineering”**, *MSc in Space Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2018–present **Fourth year course “Space Vehicles and Orbital Dynamics”**, *BSc in Aerospace Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2018–present **Second year course “Modeling in Aerospace Engineering”**, *BSc in Aerospace Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2018–present **Second year course “Mechanics applied to Aerospace Engineering”**, *BSc in Aerospace Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2014–2018 **“Space Systems Design”**, *MSc in Aeronautical Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2014–2018 **“Astrodynamics and Atmospheric Flight Dynamics”**, *MSc in Aeronautical Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2014–2018 **Second year course “Introduction to Flight Mechanics”**, *BSc in Aerospace Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2014–2017 **Fourth year course “Rocket propulsion”**, *BSc in Aerospace Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2014–2016 **Fourth year course “Aerospace Propulsion Complements I”**, *BSc in Aerospace Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2013–2015 **Third year course “Aerospace Propulsion”**, *BSc in Aerospace Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2013–2014 **Fourth year course “Space Systems”**, *BSc in Aerospace Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2012–2013 **First year course “Linear Algebra” (Matemáticas I)**, *BSc in Aerospace Engineering*, Universidad Politécnica de Madrid.
- 2010–2013 **First year course “Computer Programming” (Informática)**, *BSc in Aerospace Engineering*, Universidad Politécnica de Madrid.
- 2008–2010 **Collaboration in Teaching activities as a student.**
Problem solving teaching duties in the first year courses “General Mathematics” (Matemáticas Generales) and “Infinitesimal Calculus” (Cálculo Infinitesimal) of the former Aerospace Engineering 5-year Program at Universidad Politécnica de Madrid

Online courses:

- 2015–present **MOOC course “The Conquest of Space: space exploration and rocket science”**, *at the EdX online platform (taught in English)*, Universidad Carlos III de Madrid, <https://www.edx.org/school/uc3mx>.

Other courses and seminars:

- 2019-11 **Course on flight dynamics for many-satellite space missions**, at INTA (*Instituto Nacional de Técnica Aeroespacial*), one-week course.
- 2018-12 **Orbital mechanics for Flight Dynamics software operators**, at INTA (*Instituto Nacional de Técnica Aeroespacial*), one-week course.
- 2017-10 **Magnetic nozzles for electric propulsion**, EPIC lecture series at CDTI, Madrid, European Strategic Research Cluster EPIC.
- 2016-07 **One-week course “Rock the air, conquer space”**, including lectures on the fundamentals of rocketry and water-rocket construction and launching, in collaboration with the BEST association, Universidad Carlos III de Madrid.
- 2015-10 **Organization of a one-week introductory course to Python programming in Aerospace engineering**, in collaboration with the AeroPython association, Universidad Carlos III de Madrid.
- 2014–present **Introductory seminar on LaTeX and LyX**, two-hour seminars, taught in 2014-02-15 and 2015-02-19, Universidad Carlos III de Madrid.
- 2014-04-03 **Seminar on Electric Propulsion**, invited talk by the student association of Aeronautics and Space, Universidad Carlos III de Madrid.
- 2011-05-19 **Seminar on Magnetic nozzles for Plasma Propulsion**, seminar imparted within the seminar program of the fluid dynamics department, Universidad Politécnica de Madrid.
- 2011-03-04 **Introduction to Fortran**, four-hour seminar, Universidad Politécnica de Madrid.

Direction of BSc and MSc theses:

- 2021 **MSc Aerospace Engineering Thesis**, *Design of the AOCS system of a 6U satellite for Earth and Space observation*, Rodrigo Santos García (ongoing), Universidad Carlos III de Madrid.
- 2021 **MSc Aerospace Engineering Thesis**, *Development and implementation of a DKE space simulator for cubesat missions*, Alicia Miró Moncho (ongoing), Universidad Carlos III de Madrid.
- 2021 **BSc Aerospace Engineering Thesis**, *Nonlinear data analysis applied to plasma space propulsion*, Clara Puerto Sánchez (ongoing), Universidad Carlos III de Madrid.
- 2020 **BSc Aerospace Engineering Thesis**, *Analysis of Orbital Relay Stations for orbital energy accumulation*, Juan José García Ortiz, Universidad Carlos III de Madrid.
- 2020 **BSc Aerospace Engineering Thesis**, *Design and Development of a μ -PPT thrust balance*, Andrés Cabello López, Universidad Carlos III de Madrid.
- 2020 **MSc Aerospace Engineering Thesis**, *Kalman Filter for precise AOCS control*, Javier Gómez del Pulgar Vázquez, Universidad Carlos III de Madrid, carried out at SENER Aeroespacial.
- 2020 **MSc Aeronautical Engineering Thesis**, *Helicon Plasma Thruster Full Wave Simulations*, Pedro José Jiménez Jiménez, Universidad Carlos III de Madrid.
- 2019 **MSc Aeronautical Engineering Thesis**, *Design of a space mission with Model-Based Systems Engineering tools*, Laura González Llamazares, Universidad Carlos III de Madrid.
- 2019 **BSc Aerospace Engineering Thesis**, *Cross-section database generation for hybrid PIC/fluid plasma codes*, Antonio Castillo Sauca, Universidad Carlos III de Madrid.

- 2018 **MSc Aeronautical Engineering Thesis**, *Fluid-kinetic modeling of propulsive magnetic nozzles*, Judit del Pino Nuez Deniz, Universidad Carlos III de Madrid.
- 2018 **MSc Aeronautical Engineering Thesis**, *Advanced simulation of the complete electric propulsion system associated to the Hall-effect Thruster in EcosimPro*, Jorge Ruiz Torralba, Universidad Carlos III de Madrid, carried out at EA.
- 2018 **MSc Aeronautical Engineering Thesis**, *Preliminary Design and Analysis of the Thermal Architecture for the SMILE Satellite Payload Module*, Lorena del Amo Martín, Universidad Carlos III de Madrid, carried out at Airbus.
- 2018 **BSc Aerospace Engineering Thesis**, *Viability and considerations of the electronic components of an observation satellite's PDU orbiting in LEO*, Paloma Maestro Redondo, Universidad Carlos III de Madrid, carried out at Airbus.
- 2018 **BSc Aerospace Engineering Thesis**, *Two-dimensional finite difference code for wave-plasma interaction problems in electric thrusters*, Pedro José Jiménez Jiménez, Universidad Carlos III de Madrid.
- 2018 **BSc Aerospace Engineering Thesis**, *Design and analysis of a micropropulsion thruster*, Adrián Rubio García, Universidad Carlos III de Madrid.
- 2018 **BSc Aerospace Engineering Thesis**, *Evaluation and comparison of atmospheric models for space applications*, Elena Odriozola Olavarria, Universidad Carlos III de Madrid, carried out at GMV.
- 2017 **BSc Aerospace Engineering Thesis**, *Characterization and improvement of a hybrid chemical rocket*, Lara Cristina Sánchez Hernández, Universidad Carlos III de Madrid.
- 2017 **BSc Aerospace Engineering Thesis**, *Implementation and characterization of an open-source plasma plume code*, Pablo Moreno de Santos, Universidad Carlos III de Madrid.
- 2017 **BSc Aerospace Engineering Thesis**, *Development of a SW suite for space missions analysis*, Jorge Alonso Rosell, Universidad Carlos III de Madrid, carried out at GMV.
- 2016 **MSc Aeronautical Engineering Thesis**, *CAMSO integration in Eurofighter program*, Cristina Briongos Méndez, Universidad Carlos III de Madrid, carried out at Airbus.
- 2016 **BSc Aerospace Engineering Thesis**, *Design and construction of an upgraded hybrid rocket*, Sara Esteban Corchado, Universidad Carlos III de Madrid.
- 2016 **BSc Aerospace Engineering Thesis**, *Analysis of an orbit control strategy for LEO satellites based on ground track deviation monitoring*, Francisco Javier Hernández Castro, Universidad Carlos III de Madrid, carried out at GMV.
- 2015 **BSc Aerospace Engineering Thesis**, *Design and implementation of an Eyassat command and control center*, Daniel Expósito Jiménez, Universidad Carlos III de Madrid.
- 2014 **BSc Aerospace Engineering Thesis**, *Design of a Helicon Plasma Thruster prototype*, Santiago Casado Pérez, Universidad Carlos III de Madrid.

Teaching innovation projects:

- 2019–2020 **Development of YouTube videotutorials**, *Mechanics Applied to Aerospace Engineering*, Universidad Carlos III de Madrid.
- 2018–2019 **Step-by-step videos with Problem-solving**, *Mechanics Applied to Aerospace Engineering*, Universidad Carlos III de Madrid.

2016–2017 **Learning and evaluation by means of the design, building, and testing of water rockets**, *Rocket Motors BSc course in Aerospace Engineering*, Universidad Carlos III de Madrid.

Courses and Workshops attended

- 2020-01 **Direction of academic teams**, *Universidad Carlos III de Madrid*, (duration: 6 hours).
- 2020-01 **How to submit your research data to an open-access repository**, *Universidad Carlos III de Madrid*, (duration: 3 hours).
- 2019-01-17 **Design and application of the Flipped classroom model**, *Universidad Carlos III de Madrid*, (duration: 6 hours).
- 2018-09 **Open Source Cubesat Workshop**, *European Space Astronomy Centre (ESAC)*, Villanueva de la Cañada, Madrid (duration: 2 day).
- 2018-06 **Workshop: New teaching models, new student competences**, *Vicerrectorado de Estrategia y Educación Digital UC3M*, Getafe, Madrid (duration: 1 day).
- 2017-03 **International Workshop on Ion Propulsion and accelerator industrial applications**, *Consiglio Nazionale delle Ricerche*, Bari, Italy (duration: 2 day).
- 2016-12 **Course on teaching development**, *Universidad Carlos III de Madrid*, Leganés, Madrid (duration: 10 h).
- 2016-11 **7th Research and technology days on Space Systems Design & Engineering**, *Airbus Safran Launchers and Airbus DS*, Paris, France (duration: 2 day).
Workshop on Multidisciplinary Optimization & Concurrent Engineering.
- 2016-07 **AIAA Workshop on Hall-effect thruster electron anomalous transport**, *AIAA*, Salt Lake City, Utah (duration: 1 day).
- 2015 **Course on Entrepreneurship and creation of technology-based businesses 'Actúa-UPM'**, *Universidad Politécnica de Madrid*, Madrid, Spain (duration: 40 h).
- 2014-05 **Oerlikon's Vacuum technique technical days**, *Oerlikon, Leybold Vacuum*, Madrid (duration: 1 day).
- 2013-08 **Workshop: Quo vadis, Europa?**, *Universidad Internacional Menéndez Pelayo*, Santander, Spain (duration: 1 week).
- 2013-04 **Establishing and achieving work objectives**, *Instituto de Ciencias de la Educación, Universidad Politécnica de Madrid*, Madrid, Spain (duration: 2 days).
- 2013-03 **Galaxies and Cosmology**, *Coursera online course*, imparted by CalTech (duration 1 month).
- 2012-12 **Quantum Mechanics and Quantum Computation**, *Coursera online course*, imparted by U. Berkeley (duration 1 month).
- 2012-03 **SPIS (Spacecraft-Plasma Interaction System) software training course**, *ESTEC-ESA*, Noordwijk, The Netherlands (duration: 1 week).
- 2012-03 **Course on Time Management**, *Instituto de Ciencias de la Educación, Universidad Politécnica de Madrid*, Madrid, Spain (duration: 2 days).
- 2011-08 **Europe and Global Government (Global Economy)**, *taught by Josep Borrell, at Universidad Internacional Menéndez Pelayo*, Santander, Spain (duration: 1 week).
- 2010–2011 **Course on Initial Teaching Education**, *Instituto de Ciencias de la Educación, Universidad Politécnica de Madrid*, Madrid, Spain (4 ECTS).

- 2010-08 **Summer School "Blas Cabrera" on Research, Teaching and Innovation**, *Universidad Internacional Menéndez Pelayo*, Santander, Spain (duration: 1 week).
- 2010-04 **EcosimPro Software training course**, *Escuela Técnica Superior de Ingenieros Aeronáuticos / Empresarios Agrupados*, Madrid, Spain (duration: 1 week).
- 2010-03 **ATHENS Course "The PIV method in Fluid Mechanics"**, *ATHENS Program*, *Czech Technical University*, Prague, Czech Republic (duration: 1 week).
- 2009-11 **ATHENS Course "Nanotechnologies"**, *ATHENS Program*, *École Nationale Supérieure des Techniques Avancées, ParisTech*, Paris, France (duration: 1 week).
- 2008-11 **Workshop on Satellite Navigation**, *Escuela Técnica Superior de Ingenieros Aeronáuticos / GMV*, Madrid, Spain (duration: 10 days).
- 2007-08 **CVA Summer School on the preparation of future European launch vehicles**, *Community of Ariane Cities (CVA) / Fachhochschule Heilbronn*, Heilbronn, Germany (duration: 1 month).

Dissemination activity

- 2020-11 **Learning Scientific Computing with Julia**, *Madrid Week of Science*, Universidad Carlos III de Madrid.
- 2019-11 **When the sky falls on our heads: building a cloud chamber**, *Madrid Week of Science*, Universidad Carlos III de Madrid.
- 2019-11 **How do Satellites Communicate?**, *Madrid Week of Science*, Universidad Carlos III de Madrid.
- 2019-10 **Space plasma propulsion: Science, or science-fiction?**, *European Researchers Night*, Universidad Carlos III de Madrid.
- 2018-11 **How to listen to a satellite**, *Madrid Week of Science*, Universidad Carlos III de Madrid.
- 2018-06-29 **Guest speaker in the 1h-podcast 'The future of plasma space propulsion'**, *El Gato de Hubble*, Radio GUL.
- 2018–2019 **Founder and coordinator of the dissemination association "Esto No Es Una Charla"**, which presents and discusses science/technology topics once a month in Madrid, <http://estonoesunacharla.com/>, <https://twitter.com/NoEsUnaCharla>.
- 2017-11 **Listening to satellites**, *Madrid Week of Science*, Universidad Carlos III de Madrid.
- 2016-11 **Build and launch your own water rocket**, *Madrid Week of Science*, Universidad Carlos III de Madrid.

Languages

English	Proficient	<i>Cambridge Certificate in Advanced English (2001)</i> <i>High degree from the National "Escuela Oficial de Idiomas" (2004)</i>
German	Intermediate level	<i>Universidad Politécnica de Madrid, German B2 language course (2012)</i> <i>Intermediate II degree from the National "Escuela Oficial de Idiomas" (2013)</i>
Italian	Intermediate level	<i>Merimée-De Sebastian course, National "Escuela Oficial de Idiomas" (2008)</i>
French	Intermediate level	

Miscellanea

- 2020–present **Special issue editor**, "*Plasma Propulsion*," *MDPI Aerospace*.

- 2020–present **Head of the university-industry Research Chair UC3M-SENER (St3llar laboratory)**, *dedicated to the development of novel avionics for space systems*, <https://st3llar.uc3m.es/>.
- 2020–present **Author in The Conversation**, *a network of not-for-profit media outlets that publish news stories on the Internet that are written by academics and researchers, under a Creative Commons*, <https://theconversation.com/>. My articles have received more than 23k reads.
- 2020–present **Review Editor for Advanced Space Propulsion in Journal: Frontiers in Space Technologies**, *Frontiers Publishing*.
- 2019–present **Steering Committee of the Specialized Group in Plasma Physics of the Spanish Royal Physics Society (RSEF)**.
- 2017–2019 **Member of the Celera Program third generation**, *for entrepreneurship and personal development*, <http://www.acelerame.org/>.
admitted into this competitive program in 2017
- 2016–present **Permanent representative**, *in the Academic Commission for the Aerospace Engineering Bachelor program at UC3M*.
- 2014–present **Co-founder of 'La Facultad Invisible'**, *non-profit NGO for the improvement of Spanish higher education*, <http://lafacultadinvisible.com>.
- Coordinator of the Architecture and Engineering branch of the association (2014–2015).
 - Coordinator of the organizing committee for the First Congress of 'La Facultad Invisible', which took place the 13th of June at the 'Circulo de Bellas Artes' of Madrid (June 2015).