

# Mario Merino Martínez

## Academic positions

- 2013–present **Assistant Professor (Profesor visitante)**, *Universidad Carlos III de Madrid*, Escuela Politécnica Superior, Departamento de Bioingeniería e Ingeniería Aeroespacial. ANECA accreditation for associate professorship (Profesor titular).
- 2010–2013 **Teaching assistant (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**. Thesis advisor: Prof. Eduardo Ahedo.
  - Research internship at the **Institute for Space Systems (IRS)**, Universität Stuttgart (Germany), 3 months.
  - Awarded the *International PhD Thesis Mention* by the Ministry of Education.
- 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

**Runner-up 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 grants:

- 2014 **UC3M Mobility grant,** Universidad Carlos III de Madrid, Grant used for my research internship at UCLA, CA, USA (three months).
- 2012 **PhD scholarship ‘Beca para la Formación de Profesorado Universitario’,** Spanish Ministry of Education, scholarship granted, declined in favor for Teaching Assistant contract at Universidad Politécnica de Madrid in the same period.
- 2010 **Teaching and research assistant scholarship ‘Beca de Colaboración’,** Spanish Ministry of Education, obtained during my last year of Aerospace Engineering studies at Universidad Politécnica de Madrid.
- 2009–2010 **Teaching assistant 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,** Government of Madrid, obtained during my Aerospace Engineering studies at Universidad Politécnica de Madrid.

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### Research activity

**Research interests:** Plasma space propulsion, magnetic nozzles, helicon plasma thrusters, electron-cyclotron resonance (ECR) plasma heating, ECR thrusters, expansion of magnetized and unmagnetized plasma plumes, active space debris removal, space systems engineering, general plasma physics, fluid and kinetic plasma models, numerical methods and analysis.

### Research groups:

- 2013–present AERO research group, [aero.uc3m.es](http://aero.uc3m.es).
- 2008–present Equipo de Propulsión Espacial y Plasmas (EP2) research group (Plasma and Space Propulsion Team), [ep2.uc3m.es](http://ep2.uc3m.es).
- 2008–present Member of the American Institute of Aeronautics and Astronautics (AIAA) and the Electric Rocket Propulsion Society (ERPS) professional associations.

### Internships abroad:

- 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).

### PhD thesis direction:

- 2016–present **Modeling the plasma discharge in an electron-cyclotron-resonance thruster**, doctorand: Álvaro Sánchez, Universidad Carlos III de Madrid.  
Co-direction. Thesis in progress.
- 2015–present **Modeling of physical processes in radio-frequency plasmas**, doctorand: Bin Tian, Universidad Carlos III de Madrid.  
Co-direction. Thesis in progress.
- 2014–present **Analysis of the expansion of a plasma thruster plume into vacuum**, doctorand: Filippo Cichocki, Universidad Carlos III de Madrid.  
Co-direction. Thesis in progress.

### Supervision of incoming students and visitors:

- 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 programme.  
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 programme.  
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 programme.  
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.

### Research Projects:

- 2017–2020 **MINOTOR, Magnetic NOzzle thruster with elecTron cyclOtron Resonance**, *supported by the H2020 Programme (European Commission)*, Grant number: 730028.  
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.  
Principal Investigators: Eduardo Ahedo, Pablo Fajardo.
- 2016–2020 **CHEOPS, Consortium for Hall Effect Orbital Propulsion System**, *supported by the H2020 Programme (European Commission)*, Grant number: 730135.  
Principal Investigator: Eduardo Ahedo.  
Project Manager: SAFRAN-Snecma (France).

- 2016–2018 **Technological prospective in the aerospace field**, supported by ISDEFE S.A., (specific framework contract).  
Principal Investigator: Pablo Fajardo.
- 2016–2017 **Model and experimental validation of spacecraft thruster interactions for electric propulsion thrusters plume**, supported by ESA, Contract number: 4000116180/15/NL/PS.  
Principal Investigator: Eduardo Ahedo.  
Project Manager: Airbus Defense and Space (France).
- 2016 **Experimental campaigning for the characterization and optimization of the HPT-05 Helicon Plasma Thruster prototype**, supported by SENER Ingeniería y Sistemas.  
Principal Investigator: Pablo Fajardo.
- 2015–2016 **Design and manufacturing of a Langmuir Probe for the use in RF Generated Plasmas**, supported by ESA, Contract number: 5001017118.  
Principal Investigator: Mario Merino.  
Project Manager: SENER Ingeniería y Sistemas.
- 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.  
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.  
Principal Investigators: Eduardo Ahedo, Pablo Fajardo.
- 2013–2016 **LEOSWEEP, improving Low Earth Orbit Security With Enhanced Electric Propulsion**, supported by the European 7th Framework Programme (European Commission), Grant number: 607457.  
Principal Investigator: Eduardo Ahedo.  
Project Manager: SENER Ingeniería y Sistemas.
- 2013–2015 **HPT, Helicon Plasma Thrusters for Space Missions**, supported by ESA, Contract number: 4000107292/12/NL/CO.  
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.  
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.  
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.  
Principal Investigator: Eduardo Ahedo.
- 2010–2011 **Ion Beam Shepherd for Contactless Debris Removal**, supported by ESA, Contract number: 4000101447/10/NL/CBi.  
Principal Investigator: Claudio Bombardelli.

- 2010–2013 **Propulsión Espacial por Plasma**, supported by the Ministry of Economy and Competitiveness, National I+D plan, Spanish Government, Grant number: AYA2010-16699.  
Principal Investigator: Eduardo Ahedo.
- 2008–2010 **HPH.com, Helicon Plasma Hydrazine COmbined Micro**, supported by the European 7th Framework Programme (European Commission), Grant number: 218862.  
Principal Investigator: Eduardo Ahedo.  
Project Manager: Università degli Studi di Padova (Italy).

## 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., Peláez, J., and Ahedo, E., "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, Torus Press, 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 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. 0, No. 0, 2016 (article advanced online).
- 16 Merino, M. and Ahedo, E., "Magnetic Nozzles for Space Plasma Thrusters," *Encyclopedia of Plasma Technology*, edited by J. L. Shohet, Taylor and Francis, (in press).

### Peer-reviewing activities:

Frequent peer-reviewer in *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. P201331790.

### Publications in Conference Proceedings

- 1 Ahedo, E. and Merino, M., "Two-dimensional plasma acceleration in a divergent magnetic nozzle," *45<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA 2009-5361, AIAA, Washington DC, 2009.
- 2 Ahedo, E. and Merino, M., "Acceleration of a focused plasma jet in a divergent magnetic nozzle," *31<sup>st</sup> International Electric Propulsion Conference*, No. IEPC-2009-002, Electric Rocket Propulsion Society, Fairview Park, OH, 2009.
- 3 Merino, M. and Ahedo, E., "Two-dimensional magnetic nozzle acceleration of a two-electron component plasma," *Space Propulsion Conference 2010*, Association Aéronautique et Astronautique de France, Paris, France, 2010.
- 4 Ahedo, E. and Merino, M., "Preliminary assessment of detachment in a plasma thruster magnetic nozzle," *46<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA 2010-6613, AIAA, Washington DC, 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," *47<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2011-5999, AIAA, Washington DC, 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," *47<sup>th</sup>*

- AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2011-6142, AIAA, Washington DC, 2011.
- 8 Merino, M., Ahedo, E., Bombardelli, C., Urrutxua, H., and Peláez, J., "Hypersonic Plasma Plume Expansion in Space," *32<sup>nd</sup> International Electric Propulsion Conference*, No. IEPC-2011-086, Electric Rocket Propulsion Society, Fairview Park, OH, 2011.
  - 9 Ahedo, E. and Merino, M., "On electron inertia and current ambipolarity in magnetic nozzle models," *32<sup>nd</sup> International Electric Propulsion Conference*, No. IEPC-2011-050, Electric Rocket Propulsion Society, Fairview Park, OH, 2011.
  - 10 Merino, M., Ahedo, E., Bombardelli, C., Urrutxua, H., and Peláez, J., "Ion Beam Shepherd Satellite for Space Debris Removal," *4<sup>th</sup> 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," *50<sup>th</sup> AIAA Aerospace Sciences Meeting*, No. AIAA 2012-0139, AIAA, Washington DC, 2012.
  - 12 Merino, M. and Ahedo, E., "Magnetic Nozzle Far-Field Simulation," *48<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2012-3843, AIAA, Washington DC, 2012.
  - 13 Navarro, J., Merino, M., and Ahedo, E., "Two-Fluid and PIC-Fluid Code Comparison of the Plasma Plume in a Magnetic Nozzle," *48<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2012-3840, AIAA, Washington DC, 2012.
  - 14 Navarro, J., Merino, M., and Ahedo, E., "A fluiddynamic performance model of a helicon thruster," *48<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2012-3955, AIAA, Washington DC, 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," *48<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2012-4117, AIAA, Washington DC, 2012.
  - 16 Boxberger, A., Bambach, P., Herdrich, G., Fasoulas, S., Merino, M., and Ahedo, E., "Experimental Investigation of Applied-Field Magnetoplasma Thrusters at Institute of Space Systems," *48<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2012-4012, AIAA, Washington DC, 2012.
  - 17 Merino, M. and Ahedo, E., "Influence of Electron and Ion Thermodynamics on the Magnetic Nozzle Plasma Expansion," *33<sup>rd</sup> International Electric Propulsion Conference*, No. IEPC-2013-247, Electric Rocket Propulsion Society, Fairview Park, OH, 2013.
  - 18 Navarro, J., Ahedo, E., Merino, M., Gómez, V., and Ruiz, M., "Helicon Plasma Thrusters: prototypes and advances on modeling," *33<sup>rd</sup> International Electric Propulsion Conference*, No. IEPC-2013-285, Electric Rocket Propulsion Society, Fairview Park, OH, 2013.
  - 19 Navarro, J., Ahedo, E., Merino, M., Urdampilleta, I., Ruiz, M., and del Amo, J. G., "Assessment of helicon plasma thruster technology for space missions," *Space Propulsion Conference 2014*, European Space Agency, 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*, European Space Agency, 2014.
- 21 Merino, M., Cichocki, F., and Ahedo, E., "Plasma Thruster Beam Expansion and Impingement in Space Debris," 2014.
- 22 Navarro, J., Merino, M., Ahedo, E., Ruiz, M., and Sánchez, V., "Design of Helicon Plasma Thruster subsystems," *50<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2014-3699, AIAA, Washington DC, 2014.
- 23 Cichocki, F., Merino, M., and Ahedo, E., "Modeling and simulation of EP Plasma Plume Expansion into Vacuum," *50<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA-2014-3828, AIAA, Washington DC, 2014.
- 24 Cichocki, F., Merino, M., Ahedo, E., Hu, Y., and Wang, J., "Fluid vs PIC Modeling of a Plasma Plume Expansion," *34<sup>th</sup> International Electric Propulsion Conference*, No. IEPC-2015-420, Electric Rocket Propulsion Society, Fairview Park, OH, 2015.
- 25 Cichocki, F., Merino, M., Ahedo, E., Feili, D., and Ruiz, M., "Electric Propulsion Subsystem Optimization for an IBS Mission," *34<sup>th</sup> International Electric Propulsion Conference*, No. IEPC-2015-35, Electric Rocket Propulsion Society, Fairview Park, OH, 2015.
- 26 Feili, D., Ruiz, M., Ahedo, E., Merino, M., Smirnova, M., and Dobkevicius, M., "Impulse Transfer Thruster for an Ion Beam Shepherd Mission," *34<sup>th</sup> International Electric Propulsion Conference*, No. IEPC-2015-382, Electric Rocket Propulsion Society, Fairview Park, OH, 2015.
- 27 Merino, M., Navarro, J., Casado, S., Ahedo, E., Gómez, V., Ruiz, M., Bosch, E., and del Amo, J. G., "Design and development of a 1kW-class helicon antenna thruster," *34<sup>th</sup> International Electric Propulsion Conference*, No. IEPC-2015-297, Electric Rocket Propulsion Society, Fairview Park, OH, 2015.
- 28 Merino, M. and Ahedo, E., "Towards thrust vector control with a 3D steerable magnetic nozzle," *34<sup>th</sup> International Electric Propulsion Conference*, No. IEPC-2015-414, Electric Rocket Propulsion Society, Fairview Park, OH, 2015.
- 29 Merino, M. and Ahedo, E., "Modelling the expansion of magnetized plasma jets in electric propulsion," *32<sup>nd</sup> International Conference on Plasmas and Ionized Gases*, No. TL19, European Physical Society, Iasi, Romania, 2015.
- 30 Merino, M., Navarro, 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*, No. 3125014, European Space Agency, Rome, Italy, 2016.
- 31 Cichocki, F., Rafalskyi, D., Aanesland, A., and Merino, M., "The plume neutralization process of the Pegases thruster," *Space Propulsion Conference 2016*, No. 3124967, European Space Agency, Rome, Italy, 2016.
- 32 Cichocki, F., Domínguez, A., Merino, M., and Ahedo, E., "A 3D hybrid code to study electric thruster plumes," *Space Propulsion Conference 2016*, No. 3124968, European Space Agency, Rome, Italy, 2016.



- 33 Smirnova, M., Mingo, A., Kazakov, E., Feili, D., Dobkevicius, M., Ruiz, M., Tejerina, P., Bombardelli, C., Merino, M., Cichocki, F., and Ahedo, E., "Ion Beam Shepherd Mission LEOSWEEP: mission design to ion beam thruster testing," *Space Propulsion Conference 2016*, No. 3125249, European Space Agency, Rome, Italy, 2016.
- 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*, No. 3124913, European Space Agency, Rome, Italy, 2016.
- 36 Merino, M., Proux, A., Fajardo, P., and Ahedo, E., "Collisionless electron cooling in unmagnetized plasma thruster plumes," *52<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, No. AIAA 2016-5037, AIAA, Salt Lake City, UT, 2016.

### 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, 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, 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., Pérez, D., Cichocki, F., and Ahedo, E., "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," *31<sup>st</sup> 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," *22<sup>nd</sup> SPINE Meeting and Workshop*, SPIS/SPINE Community, ESA, 2016.
- 19 Domínguez, A., Cichocki, F., Pérez, 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, A., Pérez, D., Merino, M., Ahedo, E., and Fajardo, P., "Hybrid particle codes for electric propulsion," *14<sup>th</sup> Spacecraft Charging Technology Conference*, 2016.
- 21 Merino, M., Fajardo, P., Navarro, J., Chen, X., Babou, Y., and Ahedo, E., "Characteristics and capabilities of the new EP2 plasma propulsion laboratory," *Space Propulsion Conference 2016*, 2016.

### Invited talks

- 2016-10-11 **Modeling the expansion of plasma thruster plumes in space**, *University Southampton, 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.
- 2015-07-30 **Modeling the expansion of magnetized plasma jets in electric propulsion**, *32<sup>nd</sup> ICPIG, Iași, Romania*, invited lecture.

## Teaching activity

### Direction of BSc and MSc theses:

- 2016–2017 **BSc Aerospace Engineering Thesis**, *Implementation and characterization of an open-source plasma plume code*, Pablo Moreno de Santos, Universidad Carlos III de Madrid. In progress.
- 2016 **MSc Aeronautic Engineering Thesis**, *CAMSO integration in Eurofighter program*, Cristina Briongos Méndez, Universidad Carlos III de Madrid.
- 2016 **BSc Aerospace Engineering Thesis**, *Design and construction of an upgraded hybrid rocket*, Sara Esteban Corchado, Universidad Carlos III de Madrid.
- 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.

### Aerospace engineering courses:

- 2014–present **“Space Systems Design”**, *MSc in Aeronautical Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2014–present **“Astrodynamics and Atmospheric Flight Dynamics”**, *MSc in Aeronautical Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2014–present **Fourth year course “Rocket propulsion”**, *BSc in Aerospace Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2014–present **Fourth year course “Aerospace Propulsion Complements I”**, *BSc in Aerospace Engineering (taught in English)*, Universidad Carlos III de Madrid.
- 2014–present **Second year course “Introduction to Flight Mechanics”**, *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 **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 Programing” (Informática)**, *BSc in Aerospace Engineering*, Universidad Politécnica de Madrid.
- 2008–2010 **Collaboration in Teaching activities as a student.**  
Weekly teaching in the first year courses “General Mathematics” (Matemáticas Generales) and “Infinitesimal Calculus” (Cálculo Infinitesimal) of the former Aerospace Engineering 5-year programme 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:

- 2016-11 **Build and launch your own water rocket**, *Madrid Week of Science workshop for the general public*, Universidad Carlos III de Madrid.
- 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.

### Teaching innovation projects:

- 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.

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### Courses and Workshops attended

- 2016-11 **7<sup>th</sup> 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).
- 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 Programme, Czech Technical University*, Prague, Czech Republic (duration: 1 week).
- 2009-11 **ATHENS Course "Nanotechnologies"**, *ATHENS Programme, 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).

## 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	

## Computer Skills

Scientific computing	Fortran, Matlab, Python, Julia	Symbolic calculus	Mathematica, SymPy
CAD	Solid Edge, Inkscape	Engineering	ESARAD, ESATAN, ESAComp, Ecosim-Pro
Web programming	html, css, php, javascript	General IT	GNU/Linux, Windows, L <sup>A</sup> T <sub>E</sub> X, MS Office

## Miscellanea

- 2014–2015 **Founding member and Coordinator of the Architecture and Engineering branch in 'La Facultad Invisible'**, *non-profit NGO for the improvement of Spanish higher education*, <http://lafacultadinvisible.com>.
- June 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*, <http://lafacultadinvisible.com/encuentro>.