

EDUCATION

- Massachusetts Institute of Technology (MIT)** - Cambridge, MA (USA) May 2019
Doctor of Philosophy (Ph.D.) in Nuclear Science and Engineering, specialization in Plasma Physics GPA: 4.8/5.0
- Relevant Coursework: Plasma Physics, Nuclear Fusion, Machine Learning, Optimization Methods
- Thesis: "Perturbative transport experiments and time-dependent modeling in Alcator C-Mod and DIII-D" (*Del Favero* thesis prize)
- Drexel University** - Philadelphia, PA (USA) June 2014
Master of Science (M.Sc.) in Mechanical Engineering GPA: 4.0/4.0
- Relevant Coursework: Advanced Fluid Mechanics and Heat Transfer, Numerical Methods Class rank: #1 (49 students)
- Double-Degree Master's Thesis at Politecnico di Milano (Milan, Italy), *Sept. 2014 – May 2015*
- Thesis: "Development of shape-optimization tools for the aerodynamic design of turbomachinery blades" (*Cátedra Repsol* prize)
- Universidad Politécnica de Madrid** - Madrid (Spain) April 2013
Equivalent to *Bachelor of Science (B.Sc.) and Master of Science (M.Sc.) in Industrial & Energy Engineering* GPA: 9.0/10.0
- Relevant Coursework: Nuclear Physics and Technology, Fluid Mechanics, Thermodynamics Class rank: #1 (419 students)

RELEVANT RESEARCH EXPERIENCE

- Plasma Science and Fusion Center (PSFC), Massachusetts Institute of Technology** – Cambridge (USA) May 2019 – *present*
Postdoctoral Associate
 - Contributed to development of physics basis of **SPARC** (collaboration MIT-CFS) via integrated modeling for device optimization.
 - Studied turbulence and transport in **ASDEX Upgrade** and **DIII-D** tokamaks via advanced algorithms and perturbative techniques.
 - Supported transport modeling of isotope effects in the **JET** tokamak (collaboration with MIT-ORNL).
- Plasma Science and Fusion Center (PSFC), Massachusetts Institute of Technology** - Cambridge, (USA) Sept. 2015 – May 2019
Research Assistant (Ph.D. candidate)
 - Resolved 20-year-old question in fusion research, resulting in a high-impact publication in *Physical Review Letters*.
 - Conducted experiments as session leader in **Alcator C-Mod** and **DIII-D** tokamaks. Operated laser blow-off in Alcator C-Mod.
 - Summer stay at General Atomics for the study of heat-pulses on DIII-D and power balance analysis in negative triangularity.
 - Summer stay at Max-Planck-Institut für Plasmaphysik for the implementation of VITALS tool to study **ASDEX Upgrade** plasmas.
- Laboratory of Fluid Machines, Politecnico di Milano** - Milan (Italy) Sept. 2014 – May 2015
Research Fellow
 - Optimized Organic Rankine Cycle (ORC) turbine stage, resulting in half pressure losses compared to original designs.
 - Developed automatic shape-optimization tool for turbomachinery blades using evolutionary strategies and surrogate models.
- Drexel University** - Philadelphia, PA (USA) January 2014 – June 2014
Research Assistant (M.Sc. candidate)
 - Investigated CO₂ decomposition through micro-scale non-thermal plasma discharges via CFD simulations.

MAIN RESEARCH INTERESTS

Whole-device integrated modeling for tokamak design • Validation of reduced transport simulations • Machine learning algorithms (e.g. Bayesian optimization and neural networks) for physics applications • Fusion reactor optimization with high-fidelity physics models • Perturbative transport and drift-wave turbulence physics in tokamak plasmas

HONORS, AWARDS & FELLOWSHIPS

- Forbes 30 Under 30 in Science Forbes Magazine, Dec 2020
- Del Favero* Doctoral Thesis Prize for most innovative advance in the field MIT Nuclear Science and Engineering, Dec 2019
- Young Engineer* Early Career Achievement Award Alumni Association ETSII-UPM, Jun 2018
- Manson Benedict* Award for Academic Excellence and Professional Promise MIT Nuclear Science and Engineering, May 2018
- MIT International Science and Technology Initiatives (MISTI) Scholarship MIT MISTI program, May 2018
- Award for the Best Student in Industrial and Energy Engineering (*two awards*) ETSII-UPM, Dec 2015
- Repsol* Award for the Best Master's Thesis Project Cátedra Repsol ETSII-UPM, Dec 2015
- Caja Ingenieros* Award for Excellent Academic Progress Caja Ingenieros UPM, Dec 2015
- La Caixa* Fellowship for graduate studies in North America Banking Foundation la Caixa, Jul 2014

- Excellence in Performance Award Drexel University, Jun 2014
- ERASMUS Scholarship for graduate studies European Union & Government of Spain, Apr 2014
- *Enrique Rodríguez-Marín* Award for Excellent Academic Progress Romanillos Foundation, Mar 2014
- Award for Excellent Academic Progress (*received twice*) Government of Madrid, Jan 2014 & Jan 2011
- Atlantis Fellowship for Graduate Studies, EAGLES Consortium FIPSE U.S. & European Union, Apr 2013
- High-Performing Student Award ETSII-UPM, Dec 2011
- Award for the Best Results in the University Entrance Test Universidad Complutense de Madrid, Mar 2010

EXTRACURRICULAR ACTIVITIES, SERVICE & OTHER ACHIEVEMENTS

- **Guest Seminar Speaker/Lecturer:**
 - Plasma physics seminar at University of Wisconsin-Madison, Oct 2020.
 - Invited speaker at *Frontiers of Plasma Physics Colloquium*, organized by the Journal of Plasma Physics, Oct 2020.
 - 2019 *Del Favero Prize* Lecturer, MIT Nuclear Science and Engineering, Cambridge (MA), Dec 2019.
 - Invited speaker at *Frontiers of Innovation & Entrepreneurship* workshop, organized by MIT Sloan & FRdP Foundation, Jun 2019.
 - Invited speaker at *Call for Talent 2018 & 2019* workshops, organized by Univ.-Empresa & FRdP Foundations, Nov 2018 & Jun 2019.
 - Special Fusion Seminar at Dutch Institute of Fundamental Energy Research DIFFER, Eindhoven (Netherlands), Aug 2018.
 - Signature speaker at 2018 MIT NSE Graduate Research Expo, Cambridge (MA), Mar 2018.
 - Speaker at 2nd Joint Meeting of Spanish Scientists in US, Cambridge (MA), Jun 2017.
- **Relevant Media Articles/Interviews/Documentaries:**
 - Features in press about Forbes 30 Under 30 (2020, <https://bit.ly/2JLSJEB>, <https://bit.ly/36HmNKx>)
 - Article for Cambridge University Press on the publication of the SPARC Physics Basis (2020, <https://bit.ly/36Uv6mW>).
 - Features in press about publication of SPARC Physics Basis (2020, <https://nyti.ms/3l6hWXH>, <https://bit.ly/33NvIht>).
 - *MIT News* articles following publication in PRL (2018, <http://bit.ly/34blDDZ>) and Del Favero award (2019, <http://bit.ly/34GGEge>).
 - TV Appearances for fusion outreach: *La Sexta* (2018, <http://bit.ly/321MyQz>) and *Telemadrid* (2019, <http://bit.ly/33AD6UF>).
 - Article for Spanish Nuclear Society's *SNE* monthly magazine (2019, <http://bit.ly/2Zllg4U>).
 - Interviews for *Xataka* (2018, <http://bit.ly/2ZrxRoh>) and *Onda Madrid Radio* (2018, <http://bit.ly/2ZqG3Ft>).
- **Leadership:** Executive Committee of Spain@MIT association (2016-2019), Students Representative at ETSII-UPM (2009- 2013).
- **Referee** for: *IOP Nuclear Fusion*, *IEEE Transactions on Plasma Science* and *AIP Physics of Plasmas* journals (2018-present).
- **Volunteer** for *PSFC Education and Outreach Events* and *la Caixa Fellows Association* (2015-2019).
- **Moderator** for 1st *Computational Physics School for Fusion Research*, Cambridge (MA), Aug 2019.
- **Languages:** Spanish (native), English (fluent), Italian (intermediate), Portuguese (beginner).

FIRST-AUTHOR PEER-REVIEWED PUBLICATIONS

- **P. Rodríguez-Fernandez**, N. T. Howard, M. J. Greenwald, A. J. Creely, J. W. Hughes, J. C. Wright, C. Holland, Y. Lin, F. Sciortino and the SPARC team, "Predictions of core plasma performance for the SPARC tokamak", *Journal of Plasma Physics* 86(5), 865860503 (2020). <https://doi.org/10.1017/S0022377820001075>
- **P Rodríguez-Fernandez**, A E White, N T Howard, B A Grierson, L Zeng, X Yuan, G M Staebler, M E Austin, T Odstrcil, T L Rhodes, F Sciortino, J E Rice, K Thome, C Angioni, E Fable and O Meneghini, "Predict-first Experiments and Modeling of Perturbative Cold Pulses in the DIII-D Tokamak", *Phys. Plasmas* 26, 062503 (2019). <https://doi.org/10.1063/1.5096800>
- **P Rodríguez-Fernandez**, A E White, N T Howard, B A Grierson, X Yuan, G M Staebler, J E Rice, C Angioni, N M Cao, A J Creely, E Fable, M J Greenwald, A E Hubbard, J W Hughes, J H Irby and F Sciortino, "Perturbative Transport Modeling of Cold-Pulse Dynamics in Alcator C-Mod Ohmic Plasmas", *Nucl. Fusion* 59, 066017 (2019) <https://doi.org/10.1088/1741-4326/ab1575>
- **P Rodríguez-Fernandez**, A E White, N T Howard, J E Rice, F Sciortino, N M Cao, A J Creely, M J Greenwald, A E Hubbard, J W Hughes, J H Irby, X Yuan, B A Grierson, G M Staebler, C Angioni and E Fable, "Modeling of Cold-Pulse Propagation and Associated Phenomena in Tokamak Plasmas", *Proceedings of 27th IAEA Fusion Energy Conference (Gandhinagar)*, IAEA-CN-258 EX/10-3.
- **P Rodríguez-Fernandez**, A E White, N T Howard, B A Grierson, G M Staebler, J E Rice, X Yuan, N M Cao, A J Creely, M J Greenwald, A E Hubbard, J W Hughes, J H Irby and F Sciortino, "Explaining cold-pulse dynamics in tokamak plasmas using local turbulent transport models", *Phys. Rev. Lett.* 120, 075001 (2018). <http://dx.doi.org/10.1103/PhysRevLett.120.075001>
- **P Rodríguez-Fernandez**, A E White, A J Creely, M J Greenwald, N T Howard, F Sciortino and J C Wright, "VITALS: A surrogate-based optimization framework for the accelerated validation of plasma transport codes", *Fusion Technol.* 74:1-2, 65-76 (2018). <http://dx.doi.org/10.1080/15361055.2017.1396166>
- **P Rodríguez-Fernandez**, J E Rice, N M Cao, A J Creely, N T Howard, A E Hubbard, J H Irby and A E White, "On the correlation between "non-local" effects and intrinsic rotation reversals in Alcator C-Mod", *Nucl. Fusion* 57, 074001 (2017). <http://dx.doi.org/10.1088/1741-4326/aa6e89>

- **P Rodriguez-Fernandez** and G Persico, "Automatic design of ORC turbine profiles using evolutionary algorithms", ASME ORC 3rd Int'l Seminar on ORC Power Systems, Brussels (Belgium), Oct 2015. <http://bit.ly/2ZqGcZx>

CO-AUTHORED PEER-REVIEWED PUBLICATIONS

- A. J. Creely, M. J. Greenwald, S. B. Ballinger, D. Brunner, J. Canik, J. Doody, et al., "Overview of the SPARC Tokamak", Journal of Plasma Physics 86(5), 865860502 (2020). <https://doi.org/10.1017/S0022377820001257>
- J. W. Hughes, N. T. Howard, **P. Rodriguez-Fernandez**, A. J. Creely, A. Q. Kuang, P. B. Snyder, T. M. Wilks, R. Sweeney, and M. Greenwald. 2020. "Projections of H-Mode Access and Edge Pedestal in the SPARC Tokamak", Journal of Plasma Physics 86(5), 865860504 (2020). <https://doi.org/10.1017/S0022377820001300>
- S. D. Scott, G. J. Kramer, E. A. Tolman, A. Snicker, J. Varje, K. Särkimäki, J. C. Wright, and **P. Rodriguez-Fernandez**, "Fast-Ion Physics in SPARC", Journal of Plasma Physics 86(5), 865860508 (2020). <https://doi.org/10.1017/S0022377820001087>
- F. Sciortino, N. T. Howard, E. S. Marmor, T. Odstrcil, N. M. Cao, R. Dux, A. E. Hubbard, J. W. Hughes, J. H. Irby, Y. Marzouk, L. M. Milanese, M. L. Reinke, J. E. Rice and **P. Rodriguez-Fernandez**, "Inference of experimental radial impurity transport on Alcator C-Mod: Bayesian parameter estimation and model selection", Nucl. Fusion 60 126014 (2020). <https://doi.org/10.1088/1741-4326/abae85>
- N. M. Cao, J. E. Rice, P. H. Diamond, A. E. White, M. A. Chilenski, P. C. Ennever, J. W. Hughes, J. Irby, M. L. Reinke, **P. Rodriguez-Fernandez**, and Alcator C-Mod Team, "Evidence and modeling of turbulence bifurcation in L-mode confinement transitions on Alcator C-Mod", Physics of Plasmas 27, 052303 (2020). <https://doi.org/10.1063/1.5144444>
- A. J. Creely, L. M. Milanese, E. A. Tolman, J. H. Irby, S. B. Ballinger, S. Frank, A. Q. Kuang, B. L. Linehan, W. McCarthy, K. J. Montes, T. Mouratidis, J. F. Picard, **P. Rodriguez-Fernandez**, A. M. Rosenthal, A. J. Sandberg, F. Sciortino, R. A. Simpson, R. A. Tinguely, M. Zhou, and A. E. White, "Design study of a combined interferometer and polarimeter for a high-field, compact tokamak", Physics of Plasmas 27, 042516 (2020). <https://doi.org/10.1063/1.5142638>
- T. Fülöp, P. Helander, O. Vallhagen, O. Embréus, L. Hesslow, P. Svensson, A. J. Creely, N. T. Howard and P. Rodriguez-Fernandez, "Effect of plasma elongation on current dynamics during tokamak disruptions", Journal of Plasma Physics, 86(1), 474860101 (2020). <https://doi.org/10.1017/S002237782000001X>
- C. Angioni, E. Fable, F. Ryter, **P. Rodriguez-Fernandez** and T. Pütterich, "The local nature of the plasma response to cold pulses with electron and ion heating at ASDEX Upgrade", Nucl. Fusion 59, 106007 (2019). <https://doi.org/10.1088/1741-4326/ab313f>
- N. M. Cao, J. E. Rice, P. H. Diamond, A. E. White, S. G. Baek, M. A. Chilenski, J. W. Hughes, J. Irby, M. L. Reinke, **P. Rodriguez-Fernandez** and the Alcator C-Mod Team, "Hysteresis as a Probe of Turbulent Bifurcation in Intrinsic Rotation Reversals on Alcator C-Mod" Nucl. Fusion (2019). <https://doi.org/10.1088/1741-4326/ab3b38>
- A. J. Creely, **P. Rodriguez-Fernandez**, G. D. Conway, S. J. Freethy, N. T. Howard, A. E. White and the ASDEX Upgrade Team, "Criteria for the Importance of Multi-scale Interactions in Plasma Turbulent Transport Simulations", Plasma Phys. Control. Fusion 61, 085022 (2019). <https://doi.org/10.1088/1361-6587/ab24ae>
- R. A. Tinguely, A. Rosenthal, R. Simpson, S. B. Ballinger, A. J. Creely, S. Frank, A. Q. Kuang, B. L. Linehan, W. McCarthy, L. M. Milanese, K. J. Montes, T. Mouratidis, J. F. Picard, **P. Rodriguez-Fernandez**, A. J. Sandberg, F. Sciortino, E. A. Tolman, M. Zhou, B. N. Sorbom, Z. S. Hartwig and A. E. White, "Neutron Diagnostics for the Physics of a High-Field, Compact, Q≥1 Tokamak", Fusion Eng. Des. 143, pp. 212-225 (2019). <https://doi.org/10.1016/j.fusengdes.2019.03.148>
- G. Persico, **P. Rodriguez-Fernandez** and A. Romei, "High-Fidelity Shape-Optimization of Non-Conventional Turbomachinery by Surrogate Evolutionary Strategies", ASME. J. Turbomach. 141(8), 081010-081010-11 (2019) <http://dx.doi.org/10.1115/1.4043252>
- J. Rice, F. Rosmej, N. Cao, M. Chilenski, N. Howard, A. Hubbard, J. Hughes, J. Irby, Y. Lin, **P. Rodriguez-Fernandez**, S. Wolfe, S. Wukitch, M. Bitter, L. Delgado-Aparicio, K. Hill and M. Reinke, "X-ray Observations of K β Emission from Medium Z He-like Ions in C-Mod Tokamak Plasmas", J. Phys. B: At. Mol. Opt. Phys. 51, 035702 (2018). <http://dx.doi.org/10.1088/1361-6455/aaa17f>
- N. T. Howard, C. Holland, A. E. White, M. J. Greenwald, **P. Rodriguez-Fernandez**, J. Candy and A. J. Creely, "Multi-scale gyrokinetic simulations of an Alcator C-Mod, ELM-y H-mode plasma", Plasma Phys. Control. Fusion 60, 014034 (2017). <http://dx.doi.org/10.1088/1361-6587/aa9148>
- A. J. Creely, N. T. Howard, **P. Rodriguez-Fernandez**, N. Cao, A. E. Hubbard, J. W. Hughes, J. E. Rice, A. E. White, J. Candy, G. M. Staebler, G. D. Conway, S. J. Freethy and C. Sung, "Validation of nonlinear gyrokinetic simulations of L- and I- mode plasmas on Alcator C-Mod", Phys. Plasmas 24, 0.56104 (2017). <http://dx.doi.org/10.1063/1.4977466>
- B. LaBombard, A. Q. Kuang, D. Brunner, I. Faust, R. Mumgaard, M. L. Reinke, J. L. Terry, N. Howard, J. W. Hughes, M. Chilenski, Y. Lin, E. Marmor, J. E. Rice, **P. Rodriguez-Fernandez**, G. Wallace, D. G. White, S. Wolfe and S. Wukitch, "Impurity screening behavior of the high-

field side scrape-off layer in near-double-null configurations: prospect for mitigating plasma-material interactions on RF actuators and first-wall components", Nucl. Fusion 57, 076021 (2017). <http://dx.doi.org/10.1088/1741-4326/aa6dd2>

INVITED CONTRIBUTIONS TO CONFERENCES

- (upcoming) 28th IAEA Fusion Energy Conference, Nice (France), May 10-15 2021. "Overview of the SPARC physics basis towards the exploration of burning-plasma regimes in high-field, compact tokamaks" (Overview poster)
- 4th Asia-Pacific Conference on Plasma Physics, Association of Asia-Pacific Physical Societies, Virtual Meeting, Oct 26-31 2020. "On the local nature of cold-pulse experiments in Alcator C-Mod, DIII-D and ASDEX Upgrade"
- 2nd International Conference of Data Driven Plasma Science, Marseille (France), May 13-17 2019. "Surrogate-Based Optimization Techniques for the Validation of Plasma Transport Models"
- ITPA Transport and Confinement Topical Group Meeting Spring 2019, Austin (TX), Mar 25-27 2019. "Multi-machine study of cold-pulse dynamics: Towards a local model for the temperature inversion effect".
- 60th Annual Meeting of the APS Division of Plasma Physics, Portland (OR), Nov 5-9 2018. "Understanding cold-pulse dynamics in tokamak plasmas using local turbulent transport models".
- 27th IAEA Fusion Energy Conference, Gandhinagar (India), Oct 22-27 2018. "Explaining cold-pulse dynamics in tokamak plasmas using local turbulent transport models".
- 23rd Joint EU-US Transport Task Force Meeting, Sevilla (Spain), Sep 11-14 2018. "Modeling of cold-pulse dynamics in Alcator C-Mod and DIII-D: A local turbulent transport approach".
- US Transport Task Force Workshop, San Diego (CA), May 8-1 2018. "Prediction of cold-pulse dynamics in tokamak plasmas using quasilinear turbulent transport models".
- ITPA Transport and Confinement Topical Group Meeting Spring 2018, Daejeon (Republic of Korea), Apr 9-11 2018. "An introduction to VITALS: surrogate models to accelerate transport model validation".
- ITPA Transport and Confinement Topical Group Meeting Spring 2018, Daejeon (Republic of Korea), Apr 9-11 2018. "Modeling cold-pulse propagation in Alcator C-Mod plasmas using TGLF".

Other contributions to conferences:

- 6 contributed oral presentations (APS-DPP 2020, APS-DPP 2019, APS-DPP 2018, IAEA-TM 2017, APS-DPP 2016, GK-TWGM 2016).
- 6 contributed poster presentations (EPS 2021, EPS 2019, EPS 2018, APS-DPP 2017, US-TTF 2017, US-TTF 2016).