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E-mails: vduarte@pppl.gov, vnd@princeton.eduORCID: [0000-0001-8096-7518](https://orcid.org/0000-0001-8096-7518); Google Scholar: [princeton.edu/~vnd/](https://scholar.princeton.edu/~vnd/)**Professional appointments**

Princeton Plasma Physics Laboratory

Jan 2024 – Research Physicist
 Oct 2020 – Dec 2023 Staff Research Physicist
 May 2018 – Sep 2020 Associate Research Physicist

Graduate Program in Plasma Physics, Department of Astrophysical Sciences, Princeton UniversitySep 2026 – Lecturer, *Analytical Techniques in Differential Equations***Education**

Mar 2012 – Jun 2017 PhD in Physics, University of São Paulo, with 3 years of thesis work at Princeton Plasma Physics LaboratoryThesis: *Quasilinear and nonlinear dynamics of energetic-ion-driven Alfvénic eigenmodes*Supervisors: [H.L. Berk](#), [R.M.O. Galvão](#) and [N.N. Gorelenkov](#). Funding: FAPESP and DOE.**Mar 2010 – Feb 2012 MSc in Physics, State University of Campinas**Thesis: *Helical traveling wave current drive in plasmas*Supervisor: [R. A. Clemente](#). Funding: FAPESP.**Mar 2006 – Feb 2010 BS in Physics, State University of Campinas****Research interests**

Plasma collisional kinetic theory, fast-ion-driven instabilities, radio frequency heating, reduced transport models, nonlinear wave chirping, galaxy dynamics.

Distinctions

1. [IUPAP Early Career Scientist Prize on Plasma Physics](#), 2024;
2. [Early Career Award](#), US Department of Energy, 2023 (\$2.5M in research funds);
3. [José Leite Lopes Thesis Award](#) (among all Physics thesis defended in Brazil in 2017), conferred by the Brazilian Physical Society, 2020;
4. Student Presentation Award, Transport Task Force Meeting, 2017.
5. American Institute of Physics [Scilight](#), 2017.

Service

1. [Editorial Board Member](#), Physics of Plasmas, 2023-ongoing;
2. Member of the Magnetic Confinement Theory Subcommittee, APS DPP Meeting, 2025.
3. Workshop organizer, *Synergistic approaches to particle transport in magnetized turbulence: from the laboratory to astrophysics*, Princeton Center for Theoretical Science, April 15-18 2024.
4. Promotions Committee Member, Princeton Plasma Physics Laboratory, 2024.
5. [Ronald C. Davidson Award for Plasma Physics](#), Nomination Committee, 2023;
6. [Member](#) (appointed by the US Department of Energy), ITER ITPA Energetic Particle Physics Group, 2021-ongoing;
7. [Executive Committee Member](#), Transport Task Force, term 2022-2025;
8. [Chairman](#), PPPL Energetic Particle Physics Seminar Series, 2021-2024;
9. [Expert](#), Energetic Particle Physics Topical Group, ITER Organization, 2019-ongoing;
10. Journal reviewer for: *Phys. Rev. Lett.*, *J. Plasma Phys.*, *Nucl. Fusion*, *Plasma Phys. Control. Fusion*, *Phys. Plasmas*, *Rev. Sci. Instr.*, *J. Fusion Energy*, *Braz. J. Phys.*, *Rev. Mod. Plasma Phys.*
11. Funding agency reviewer for: *US Department of Energy*, *Agence Nationale de la Recherche (France)*.

Invited and plenary talks [oral and poster contributions not shown]

1. Columbia Fusion Center Colloquium, 2026 (colloquium).
2. 21st European Fusion Theory Conference, Aix-en-Provence, France, 2025 (invited talk).
3. 18th Technical Meeting on Energetic Particles in Magnetic Confinement Systems, Sevilla, Spain, 2025 (invited talk).
4. 8th Asia Pacific Conference on Plasma Physics, Malacca, Malaysia, 2024 (plenary talk);
5. 21st International Congress on Plasma Physics, Ghent, Belgium, 2024 (invited talk). Talk in acceptance of the IUPAP Early Career Scientist Prize on Plasma Physics;
6. Journal of Plasma Physics Colloquium, remote presentation, 2024 (colloquium);
7. 7th Asia Pacific Conference on Plasma Physics, Nagoya, Japan, 2023 (invited talk);
8. 7th INFIERI, São Paulo, Brazil, 2023 (plenary talk);
9. 14th Plasma Kinetics Working Meeting, Vienna, Austria, 2023;
10. Sherwood Fusion Theory Conference, Knoxville, TN, 2023 (plenary talk);
11. 17th IAEA Technical Meeting on Energetic Particles and Theory of Plasma Instabilities in Magnetic Confinement Fusion, remote conference, 2021 (invited talk);
12. Brazilian Physical Society, Autumn Meeting, remote conference, 2020 (plenary talk). Talk in acceptance of the José Leite Lopes Award for best Physics thesis defended in Brazil in 2017;
13. 62nd American Physical Society, Division of Plasma Physics Meeting, remote conference, 2020 (invited talk);
14. 4th Asia Pacific Conference on Plasma Physics, remote conference, 2020 (invited talk);
15. Transport Task Force (TTF) Meeting, Austin, TX, 2019 (invited talk);
16. International Atomic Energy Agency, Energetic Particles Meeting, Princeton, NJ, 2017 (invited talk);
17. Transport Task Force (TTF) Meeting, Williamsburg, VA, 2017 (plenary talk – Student Presentation Prize);
18. Sherwood Fusion Theory Conference, Madison, WI, 2016 (plenary talk).

Funding

- Early Career Award, US Department of Energy, 2023-2028, *Phase-space engineering of supra-thermal particle distribution for optimizing burning plasma scenarios* (PI, \$2.5M);
- Laboratory Directed Research and Development (LDRD), 2024-2025, *Leveraging PPPL-developed tools to solve a central open problem in galactic dynamics* (PI, \$100K);
- FAPESP Fellowships at BSc, MSc and PhD levels, 2009-2017 (PI, approx. \$250K, overhead exempt).

Supervisions

Staff scientists

- Phillip J. Bonfiglio, Princeton Plasma Physics Laboratory, 2024–ongoing.

Postdocs

- Pablo Oyola, Princeton Plasma Physics Laboratory, 2024–ongoing.
- Tommaso Barberis, Princeton Plasma Physics Laboratory, 2024–ongoing.

PhD students

- Emma G. Devin, Princeton University, 2025–ongoing.
- Eamon J. Hartigan-O'Connor, Princeton University, 2026–ongoing.
- Simone Cavallero, Polytechnic University of Turin, 2026–ongoing (Ellis Fellow; co-supervised with F. Porcelli).
- Benjamin J. Q. Woods, University of York, graduated 2020 (co-supervised with R. Vann), then postdoc at the University of Leeds;

MSc students

- Cosmo M. Gallaro, Princeton University, 2026–ongoing
- Eamon J. Hartigan-O'Connor, Princeton University, 2026.
- Emma G. Devin, Princeton University, 2025.
- Nicholas M. Pham, Princeton University, 2024.

Undergraduate students

- Andy Yeoh, Oxford University, 2025.
- Eamon J. Hartigan-O'Connor, Brown University, 2021-2022 (SULI intern), then grad student at Princeton University.

Refereed publications

First-author papers:

- **Submitted or in preparation**
1. V. N. Duarte and N. N. Gorelenkov, “Integrated two-dimensional quasilinear modeling of fast ion relaxation in tokamaks”, (APS meeting invited paper, *Phys. Plasmas* in preparation).

2. V. N. Duarte, E. J. Hartigan-O'Connor, N. N. Gorelenkov, and J. B. Lestz, "Generalization of the quasilinear theory resonance function to bridge between regimes of strongly driven and marginally unstable modes", (to be submitted to *Nucl. Fusion*).

- **Published**

3. V. N. Duarte, J. B. Lestz, N. N. Gorelenkov and R. B. White, "Shifting and splitting of resonance lines due to dynamical friction in plasmas", *Phys. Rev. Lett.* **130**, 105101 (2023).
4. V. N. Duarte et al, "Perturbative analysis of low-frequency Alfvénic activity in high-field ST40 experiments", *Nucl. Fusion* **63**, 036018 (2023).
5. V. N. Duarte, "A class of solutions of the two-dimensional Toda lattice equation", *Phys. Lett. A* **385**, 126979 (2021).
6. V. N. Duarte, H. L. Berk, N. N. Gorelenkov and R. B. White, "Collisional resonance function in discrete-resonance quasilinear plasma systems" *Phys. Plasmas* **26**, 120701 (2019).
7. V. N. Duarte and N. N. Gorelenkov, "Analytical nonlinear dynamics of near-threshold eigenmodes," *Nucl. Fusion* **59**, 044003 (2019).
8. V. N. Duarte, N. N. Gorelenkov, M. Schneller, E. D. Fredrickson, M. Podestà and H. L. Berk, "Study of the likelihood for Alfvénic mode bifurcation to chirping in NSTX and predictions for ITER baseline scenarios," *Nucl. Fusion* **58**, 082013 (2018).
9. V. N. Duarte, H. L. Berk, et al, "Theory and observation of the onset of nonlinear structures due to eigenmode destabilization by fast ions in tokamaks," *Phys. Plasmas* **24**, 122508 (2017) [selected as both *Editor Pick* and *AIP Scilight*].
10. V. N. Duarte, H. L. Berk, et al, "Prediction of Nonlinear Evolution Character of Energetic-Particle-Driven Instabilities," *Nucl. Fusion* **57**, 054001 (2017).
11. V. N. Duarte, R. J. F. Sgalla, A. G. Elfmov and R. M. O. Galvão, "Heat flux effects on the dispersion relation for geodesic modes in rotating plasmas," *J. Phys. Conf. Ser.* **591**, 012004 (2015).
12. V. N. Duarte and R. A. Clemente, "Electron inertia effect on floating plasma potential," *J. Phys. Conf. Ser.* **18**, 043504 (2014).
13. V. N. Duarte, R. A. Clemente and R. Farengo, "Traveling wave current drive theory for an arbitrary m-polar configuration," *Phys. Plasmas* **20**, 032513 (2013).
14. V. N. Duarte and R. A. Clemente, "Electron inertia effects on the planar plasma sheath problem," *Phys. Plasmas* **18**, 043504 (2011).

Co-author papers:

- **Submitted or in preparation**

15. E. J. Hartigan-O'Connor, T. Barberis, E. G. Devin, A. Bierwage, and V. N. Duarte, "Behavior of kinetic instabilities in a dynamically forming resonant distribution," *ArXiv preprint* 2606.05341.
16. E. G. Devin and V. N. Duarte, "Emergence of persistent advection-diffusion transport structure of strongly-driven instabilities" *ArXiv preprint* 2510.08735 (2025).

- **Published**

17. O. Asunta, [...] V. N. Duarte et al, "Overview of ST40 results and future: Expanding the physics basis of high-field spherical tokamaks," *Nucl. Fusion* **66**, 116004 (2026).
18. H. Huang, N. Gorelenkov, X. Wei, Z. Lin, V. N. Duarte, S. Kaye, and M. Romanelli, "Verification and validation of global gyrokinetic simulation of low frequency mode in spherical tokamak" *Nucl. Fusion* **66**, 036050 (2026).
19. S. Munaretto, [...] V. N. Duarte et al "Spherical tokamak physics research in preparation for the operation of NSTX-U," *Nucl. Fusion* **66**, 035001 (2026).
20. T. Barberis and V. N. Duarte, "Perturbative model for nonlinear saturation of energetic-particle-driven modes limited by self-generated zonal modes," *Nucl. Fusion* **65**, 112005 (2025).
21. M. Salewski, D.A. Spong, S.D. Pinches, P. Aleynikov, R. Bilato, B.N. Breizman, H. Cai, D.J. Campbell, L. Chen, W. Chen, V.N. Duarte et al, "Energetic particle physics: Chapter 7 of the special issue: on the path to tokamak burning plasma operation," *Nucl. Fusion* **65**, 043002 (2025).
22. S. McNamara, [...] V. N. Duarte et al, "Overview of high temperature plasmas in the ST40 compact high-field spherical tokamak," *Nucl. Fusion* **64**, 112020 (2024).
23. J. W. Berkery, [...] V. N. Duarte et al, "NSTX-U research advancing the physics of spherical tokamaks," *Nucl. Fusion* **64**, 112004 (2024).
24. N. N. Gorelenkov, V. N. Duarte, M. Gorelenkova, S. D. Pinches and Z. Lin, "Fast ion relaxation in ITER mediated by Alfvénic instabilities" *Nucl. Fusion* **64**, 076061 (2024).

25. N. Pham and V. N. Duarte, "Evolution of coupled weakly-driven waves in a dissipative plasma," *Phys. Plasmas* **30**, 092110 (2023).
26. C. Hamilton, E. Tolman, L. Arzamasskiy and V. N. Duarte, "Galactic bar resonances with diffusion: an analytic model with implications for dynamical friction by trapped dark matter," *Astrophys. J.* **954**, 12 (2023).
27. R. B. White and V. N. Duarte, "Assessment of radial transport induced by Alfvénic resonances in tokamaks and stellarators," *Phys. Plasmas* **30**, 012502 (2023).
28. M. E. Fenstermacher, [...] V. N. Duarte et al, "DIII-D research advancing the physics basis for optimizing the tokamak approach to fusion energy," *Nucl. Fusion* **62**, 042024 (2022).
29. W. Guttenfelder, D.J. Battaglia, E. Belova, N. Bertelli, M.D. Boyer, C.S. Chang, A. Diallo, V.N. Duarte et al, "NSTX-U theory, modeling and analysis results," *Nucl. Fusion* **62**, 042023 (2022).
30. J. B. Lestz and V. N. Duarte, "Analytic quasi-steady evolution of marginally unstable kinetic plasma instabilities in the presence of drag and scattering," *Phys. Plasmas* **28**, 062102 (2021).
31. A. Bierwage, R. B. White and V. N. Duarte, "On the effect of Beating during Nonlinear Frequency Chirping," *Plasma Fusion Res.* **16**, 1403087 (2021).
32. M. A. Van Zeeland, [...] V. N. Duarte, et al, "Beam Modulation and Bump-on-tail Effects On Alfvén Eigenmode Stability in DIII-D," *Nucl. Fusion* **61**, 066028 (2021).
33. N. N. Gorelenkov and V. N. Duarte, "Microturbulence-mediated route for energetic ion transport and Alfvénic mode intermittency in tokamaks," *Phys. Lett. A* **386**, 126944 (2021).
34. R. B. White, V. N. Duarte, N. N. Gorelenkov, E. D. Fredrickson and M. Podestà, "Phase-space dynamics of Alfvén Mode Chirping," *Phys. Plasmas* **27**, 052108 (2020).
35. B. J. Q. Woods; V. N. Duarte; E. Fredrickson; N. N. Gorelenkov; M. Podestà; R. Vann, "Machine-learning-driven correlations of Alfvénic and sub-Alfvénic chirping in NSTX," *IEEE Trans. Plasma Sci.* **48**, 71 (2020).
36. R. B. White, V. N. Duarte, N. N. Gorelenkov, E. D. Fredrickson and M. Podestà, "Simulation of Alfvénic avalanche onset in NSTX," *Phys. Plasmas* **27**, 022117 (2020).
37. R. B. White; V. N. Duarte, N. N. Gorelenkov.; G. Meng, "Collisional enhancement of energetic particle Alfvénic resonance width in tokamaks," *Phys. Plasmas* **26**, 032508 (2019).
38. R. B. White, V. N. Duarte, N. N. Gorelenkov, E. D. Fredrickson, M. Podestà and H. L. Berk, "Modeling of chirping toroidal Alfvén eigenmodes in NSTX," *Phys. Plasmas* **26**, 092103 (2019).
39. R. B. White and V. N. Duarte, "A simple model for kinetic perturbative resonances in tokamaks," *Phys. Plasmas* **26**, 042512 (2019).
40. N. N. Gorelenkov, V. N. Duarte, C. Collins, M. Podestà and R. B. White, "Verification and applications of resonance broadened quasi-linear model for fast ion relaxation in the presence of Alfvénic instabilities," *Phys. Plasmas* **26**, 072507 (2019).
41. M. A. Van Zeeland, C.S. Collins, W.W. Heidbrink, M.E. Austin, X.D. Du, V.N. Duarte et al, "Alfvén Eigenmodes and Fast Ion Transport in Negative Triangularity DIII-D Plasmas," *Nucl. Fusion* **59**, 086028 (2019).
42. S. M. Kaye, D.J. Battaglia, D. Baver, E. Belova, J.W. Berkery, V.N. Duarte et al, "NSTX/NSTX-U theory, modeling and analysis results," *Nucl. Fusion* **59**, 112007 (2019).
43. M. Podestà N. N. Gorelenkov, W. W. Heidbrink, L. Bardoczi, C. S. Collins, V. N. Duarte et al, "Reduced Energetic Particle Transport models enable comprehensive time-dependent tokamak simulations," *Nucl. Fusion* **59**, 106013 (2019).
44. R. B. White, N. N. Gorelenkov, V. N. Duarte and H. L. Berk, "Resonances between high energy particles and ideal magnetohydrodynamic modes in tokamaks," *Phys. Plasmas* **25**, 102504 (2018).
45. B. J. Q. Woods, V. N. Duarte, A. De-Gol, N. N. Gorelenkov and R. G. L. Vann, "Stochastic effects on phase-space holes and clumps in systems near marginal stability," *Nucl. Fusion* **58**, 082015 (2018).
46. N. N. Gorelenkov, V. N. Duarte, M. Podestà and H. L. Berk, "Resonance broadened quasi-linear (RBQ) model for fast ion distribution relaxation due to Alfvénic eigenmodes," *Nucl. Fusion* **58**, 082016 (2018).
47. G. Meng, N. N. Gorelenkov, V. N. Duarte, H. L. Berk, R. B. White and X. Wang, "Resonance frequency broadening of wave-particle interaction in tokamaks due to Alfvénic eigenmodes," *Nucl. Fusion* **58**, 082017 (2018).
48. R. M. O. Galvão, [...], V. N. Duarte et al, "Report on recent results obtained in TCABR," *J. Phys. Conf. Ser.* **591**, 012001 (2015).

Non-refereed publications

1. V. N. Duarte, N. N. Gorelenkov and R. B. White, "Herbert L. Berk," *Phys. Today* **6** (2022).
2. V. N. Duarte and N. N. Gorelenkov; Quasi-Linear model initiative for fast ion transport, Joint Community Planning Workshop for Magnetic Fusion Energy and Fusion Materials & Technology (Informational White Paper, 2019).
3. V. N. Duarte, H. L. Berk and N. N. Gorelenkov; Criterion for chirping onset (US Burning Plasma Organization Article, 2016).

Outreach and public engagement

- [SULI Introduction to Fusion Energy and Plasma Physics Course](#), lecture on [Introduction to Plasma Physics](#) (2024).
- Colloquium: [Imaginable Horizons: On Black Holes, Fusion Energy, and Brazilian Science](#), Brazil LAB, Princeton University (2024).
- Economia do Futuro Podcast, [Novo impulso à fusão nuclear](#) (2024).
- DOE Highlight, [Collisions change how fast ions surf on plasma waves in fusion experiments and beyond](#) (2023).
- [For Fast Ions Heating a Fusion Plasma, Collisions Can Be a Drag](#), APS DPP Press Release, 2023.
- [SULI Introduction to Fusion Energy and Plasma Physics Course](#), lecture on [Introduction to Plasma Physics](#) (2023).
- Economia do Futuro Podcast, [A fusão nuclear e o futuro da energia limpa](#) (2023).
- G1, [Descoberta sobre fusão é 1º passo para aposentar as radioativas usinas nucleares no futuro; veja perspectivas](#) (2022).
- Folha de S. Paulo, [O que é fusão nuclear e por que ela ainda não pode ajudar na crise climática](#) (2021).
- Nexo, [Fusão nuclear e o futuro do planeta](#) (2021).
- Fronteiras da Ciência Podcast, [Fusão Nuclear](#) (2021).
- FAPESP Research magazine: [Creative turbulence](#) (2018).
- France Diplomatie: [Une étape dans le contrôle des plasmas pour la production d'électricité dans les réacteurs de fusion](#) (2018).
- VICE News: [Closer to the energy of the stars](#) (2018).
- Agency FAPESP: [Model predicts scenarios for energy generation using nuclear fusion](#) (2018).
- Jornal da USP: [Descoberta sobre ondas é passo rumo a reator nuclear limpo e eficiente](#) (2018).
- American Institute of Physics Scilight: [A close look at fast ion microturbulence in tokamaks builds predictive capability for fusion](#) (2017).
- Princeton University Art Museum, [Fluid Motions: A Conversation between Art and Physics](#) (2015).

Reference contacts

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