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Vicente Valenzuela-Villaseca

Curriculum Vitae

August 4, 2025

Summary

I am a plasma physicist interested in connecting astrophysical theory with laboratory experiments, currently a Lawrence Fellow at Lawrence Livermore National Laboratory. My work has pioneered experimental platforms to investigate fundamental processes in accretion discs (such as those around black holes and young stars) on laboratory scales through the use of pulsed-power and laser drivers. I have also made contributions to magnetic reconnection, MHD and collisionless shocks, the physics of jets, and other topics in magnetized high-energy density plasmas. I have published seventeen (17) peer-reviewed articles with an h-index of 6. A full list of my publications (and some work in progress) can be found below.

Employment

2025–Present **Lawrence Fellow**, *NIF and Photon Science*, Lawrence Livermore National Laboratory, USA.

2022–2025 **Postdoctoral Research Associate**, *Dept. of Astrophysical Sciences*, Princeton University, USA.

Visiting Positions

2023–Present **Academic Visitor**, *Plasma Physics Group*, Imperial College London, UK.

Education

2018–2022 **Imperial College London**, *PhD in Plasma Physics*,
Thesis: "Experimental study of magneto-inertially driven, differentially rotating plasma flows".
Advisor: Prof. Sergey V. Lebedev

2016–2018 **Pontificia Universidad Catolica de Chile**, *MSc in Experimental Physics*, Summa Cum Laude,
Thesis: "Experiments on laser-produced annular plasmas".
Advisor: Prof. Mario Favre

2010–2015 **Pontificia Universidad Catolica de Chile**, *BSc in Physics*, Summa Cum Laude,
Thesis: "Experiments on conical wire array Z-pinches".
Advisor: Dr. Felipe Veloso.

Funding, Awards, Scholarships

Research grants

2026–2028 **Principal Investigator**, *Investigating the instability of black hole accretion discs with differentially rotating plasma experiments driven by energetic lasers*, Laboratory Directed Research and Development grant, Department of Energy (LDRD-DoE), USA, (USD$1.2M total).

Funded proposals

2026–2027 **Principal Investigator**: *Evolution of magnetized differentially rotating plasmas driven by long-pulse lasers* , 2 full days of beam time at the OMEGA-60 laser facility, National Laser Users' Facility (NLUF) program, USA (USD$36,000 total).

2027 **Principal Investigator** (Co-PI: Julien Fuchs, CNRS, France): *Investigation of the non-linear evolution of long-lived perpendicular magnetized shocks*, 1 full day of beam time at the OMEGA-EP laser facility, National Laser Users' Facility (NLUF) program, USA.

2026–2027 **Co-Principal Investigator** (PI: Derek Schaeffer, UCLA, USA): *Particle heating by strongly-driven shocks in magnetized HED plasmas*, 2 full days of beam time at the OMEGA-60 laser facility, National Laser Users' Facility (NLUF) program, USA (USD$36,000 total).

2024–2025 **Principal Investigator**: *Magnetic Ω-Effect in Differentially Rotating Plasma Flows*, 2 full days of beam time at the OMEGA-60 laser facility, National Laser Users' Facility (NLUF) program, USA (USD$28,000 total).

2018 **Postgraduate Research Grant**: *New Laboratory Astrophysics Experiments Looking at Magnetically Driven Rotating Plasmas*, Royal Astronomical Society, UK (USD$1350).

2013 **Undergraduate Research Grant**: *Experiments on Plasma Jets with Potential Interest in Astrophysical Scaling*, Pontificia Universidad Catolica de Chile, Chile (USD$200).

Awards

2024 **Best Poster from a Postdoctoral Scholar**, *NIF Users Group Meeting*, awarded for "X-ray imaging and electron temperature evolution in laser-driven magnetic reconnection experiments at the National Ignition Facility".

2024 **Best Seminar Prize**, *Princeton University Postdoctoral Council*, awarded for "Rotating Plasmas, Accretion Disks, and Jets: From the Laboratory to the Universe" as the best talk at the Postdoctoral Seminar Series.

2022 **Best Talk Prize**, *International Conference on High-Energy-Density Laboratory Astrophysics (HEDLA)*, awarded for "Characterization of quasi-Keplerian, differentially rotating, free-boundary laboratory plasmas".

2021 **Postgraduate Research Symposium Prize**, *Imperial College Department of Physics*, awarded for "Structure and dynamics of pulsed-power driven differentially rotating plasmas".

Scholarships

2018–2022 **Imperial College President's PhD Scholarship.**

2016–2018 **Pontificia Universidad Catolica de Chile MSc Studentship.**

Travel grants

2024–2025 PI: NNSA Facility Access Program Travel Support for up to three co-investigators per year in project *Magnetic Ω-Effect in Differentially Rotating Plasma Flows.* (USD$12,000 maximum).

2024 NIF Users Group Meeting, Livermore, USA. (USD$2,000 maximum).

2023 LaserNET US meeting, Washington DC, USA. (USD$2,000 maximum)

2023 OMEGA Laser Users Group (OLUG) meeting, Laboratory for University of Rochester, USA. (USD$1,500).

2019 High-Energy-Density Science Summer School, UCSD, USA.

2016 Joint IAEA-ICTP College on Plasma Physics, ICTP, Italy.

2016 Annual Chilean Physics Symposium, Pontificia Universidad Catolica de Chile, Chile.

Selected Invited Talks

Apr. 2025 Twin Talk seminar, Princeton Plasma Physics Laboratory, Princeton NJ, USA.

Oct. 2024 APS Division of Plasma Physics Annual Meeting, Atlanta GA, USA.

Jul. 2024 Space, Plasma, and Climate Research Seminar, Imperial College London, London, UK.

Jun 2024 Plasma Astrophysics Seminar, Canadian Institute for Theoretical Astrophysics, University of Toronto, Toronto, Canada.

May 2024 International Conference on High Energy Density Laboratory Astrophysics (HEDLA), Tallahassee FL, USA.

Aug. 2023 Optical Imaging Congress, Optica (formerly Optical Society of America), Boston MA, USA.

Jul. 2023 International Conference on Dense Z-Pinches, Ann Arbor MI, USA.

Mar. 2023 Astrophysics Seminar, Institute for Advanced Study, Princeton NJ, USA.

Jun. 2022 EPS Plasma Physics Division Conference, Virtual.

May 2022 International Conference on High Energy Density Laboratory Astrophysics (HEDLA), Lisbon, Portugal.

Sept. 2021 Faculty of Natural Science Research Showcase, Imperial College London, London, UK.

Nov. 2021 Plasma Science and Fusion Center Seminar, Massachusetts Institute of Technology, Cambridge MA, USA.

Aug. 2021 EAPPC, BEAMS & MEGAGAUSS Conference, Biarritz, France.

Aug. 2020 Plasma Physics Seminar, University of Warwick, UK.

Academic Service and Synergistic Activities

2025 **Laboratory Basic Science (LBS) Proposal Reviewer**, Laboratory for Laser Energetics, University of Rochester, USA.

2024–Present **Dissertation Committee**, Mr Chung Hei Leung, Department of Physics and Astronomy, University of Delaware, USA.

2024–2025 **Climate Committee**, Department of Astrophysical Sciences, Princeton University, USA.

2024 **Program Committee**, LaserNet US Meeting, Austin TX, USA.

2024 **Speaker Host**, Joint Princeton University and Institute for Advanced Study Astrophysics Colloquium Series.

2023 **Conference Ally Mentor** to three undergraduate students, LaserNet US Meeting, Washington DC, USA.

2023–2025 **Founding member of the Astro Postdoctoral Council**, Department of Astrophysical Sciences, Princeton University, USA.

2023–2025 **Graduate Student liaison**, Department of Astrophysical Sciences, Princeton University, USA.

2013 **President of the Student Council**, Department of Physics and Astronomy, Pontificia Universidad Catolica de Chile.

Peer-Review

The Astrophysical Journal, Review of Scientific Instruments, High-Power Laser Science and Engineering, Journal of Plasma Physics.

Memberships

From 2025 **Full Member**, Sigma Xi, USA.

From 2022 **Member**, American Physical Society, Division of Plasma Physics, USA.

From 2017 **Fellow of the Royal Astronomical Society**, UK.

Teaching Experience

Jun. 2025 **Lecturer.** `"Laboratory Plasma Astrophysics: Theory and Selected Topics"`. Introduction to Plasmas and Fusion Course, Princeton Plasma Physics Laboratory (*1.5 hours*).

2023–2024 **Mentor** to one graduate student in the Department of Astrophysical Sciences, Princeton University, USA.

2018–2021 **Demonstrator**: Year 2 Physics "Waves and Their Propagation" undergraduate lab. Including remote demonstrator with `Lab-In-A-Box` in 2020. Department of Physics, Imperial College London, UK. (*180 hours total*)

2020 **Supervisor**: two Year 1 undergraduate experimental physics projects. Department of Physics, Imperial College London, UK. (*4 students, 12 hours total*)

2014,2018 **Teaching assistant**: "Newtonian Mechanics". Pontificia Universidad Catolica de Chile, Chile. (*48 hours total*)

2017 **Teaching assistant**: "Advanced Classical Mechanics". Pontificia Universidad Catolica de Chile, Chile. (*24 hours total*)

2014–2017 **Teaching assistant**: "Physics for Biological and Chemical Sciences". Pontificia Universidad Catolica de Chile, Chile. (*72 hours total*)

2013,2017 **Teaching assistant**: "Physics for Education". Pontificia Universidad Catolica de Chile, Chile. (*48 hours total*)

2016 **Teaching assistant**: "Special and General Relativity". Pontificia Universidad Catolica de Chile, Chile. (*24 hours total*)

2016 **Teaching assistant**: "Modern Physics". Pontificia Universidad Catolica de Chile, Chile. (*24 hours total*)

2014 **Teaching assistant**: "Electromagnetism". Pontificia Universidad Catolica de Chile, Chile. (*24 hours total*)

Publications

Seventeen publications, of which five are first-author or corresponding author.

17. 2025 Orusa, L. & **Valenzuela-Villaseca, V.** (*co-corresponding author*). *Criteria for ion acceleration in laboratory perpendicular magnetized collisionless shocks: when are 2D simulations enough?* Physics of Plasmas 32, 052901. `https://doi.org/10.1063/5.0269035`

16. 2024 Griff-McMahon, J., **Valenzuela-Villaseca, V.**, Malko, S., Fiksel, G., Rosenberg, M. J., Schaeffer, D. B., Fox, W., *Proton radiography inversions with source extraction and comparison to mesh methods*. Physical Review E, 110, 055202. `https://doi.org/10.1103/PhysRevE.110.055202`

15. 2024 **Valenzuela-Villaseca, V.**, Suttle, L. G., Suzuki-Vidal, F., Halliday, J. W. D., Merlini, S., Russell, D. R., Tubman, E. R., Hare, J. D., Chittenden, J. P., Koepke, M. E., Lebedev, S. V., *Structure and dynamics of magneto-inertial, differentially rotating laboratory plasmas*. Journal of Plasma Physics, 90, 915900401. `https://doi.org/10.1017/S0022377824000710`

14. 2024 **Valenzuela-Villaseca, V.**, Molina, J. M., Schaeffer, D. B., Malko, S. Griff-McMahon, J., Lezhnin, K., Rosenberg, M. J., Hu, S. X., Kalantar, D., Trosseille, C., Park, H. -S., Remington, B. A., Fiksel, G., Uzdensky, D., Fox, W., *X-ray imaging and electron temperature evolution in laser-driven magnetic reconnection experiments at the National Ignition Facility*. Physics of Plasmas, 31, 082106. `https://doi.org/10.1063/5.0213598`

13. 2024 Griff-McMahon, J., Malko, S., **Valenzuela-Villaseca, V.**, Walsh, C. A., Fiksel, G., Rosenberg, M., Schaeffer, D. B., Fox, W., *Measurements of extended magnetic fields in laser-solid interactions*. Physical Review Research, 6, 033312. `https://doi.org/10.1103/PhysRevResearch.6.033312`

12. 2024 Malko, S., Schaeffer, D. B., Yao, W., **Valenzuela-Villaseca, V.**, Johnson, C., Fiksel, G., and Ciardi, A., Fox, W., *Observation of a magneto-Rayleigh-Taylor instability in magnetically collimated plasma jets*. Physical Review Research, 6, 023330. `https://doi.org/10.1103/PhysRevResearch.6.023330`

11. 2024 **Valenzuela-Villaseca, V.**, Suttle, L. G., Suzuki-Vidal, F., Halliday, J. W. D., Merlini, S., Russell, D. R., Tubman, E. R., Hare, J. D., Chittenden, J. P., Koepke, M. E., Lebedev, S. V., *On the Structure of Plasma Jets in the Rotating Plasma Experiment*. IEEE Transactions On Plasma Science, `https://doi.org/10.1109/TPS.2024.3387304`

10. 2023 **Valenzuela-Villaseca, V.**, Suttle, L. G., Suzuki-Vidal, F., Halliday, J. W. D., Merlini, S., Russell, D. R., Tubman, E. R., Hare, J. D., Chittenden, J. P., Koepke, M. E., Lebedev, S. V., *Characterization of quasi-Keplerian, Differentially Rotating, Free-Boundary Laboratory Plasmas*. Physical Review Letters, 130, 195101.
Editor's Suggestion. https://doi.org/10.1103/PhysRevLett.130.195101.
Featured in *Physics Magazine* https://physics.aps.org/articles/v16/81.

9. 2023 Russell, D. R., Burdiak, G. C., Carroll-Nellenback, J. J., Halliday, J. W. D., Hare, J. D., Merlini, S., Smith, R. A., Suttle, L. G., **Valenzuela-Villaseca, V**, J. J., Eardley, S. J, Fullalove, J. A., Rowland, G. C., Smith, R. A., Frank, A., Hartigan, P., Velikovich, A. L., Lebedev, S. V., *Observation of subcritical shocks in a collisional laboratory plasma: scale dependence near the resistive length*. Journal of Plasma Physics 84, 915890401. https://doi.org/10.1017/S0022377823000740

8. 2023 Merlini, S., Hare, J. D., Burdiak, G. C., Halliday, J. W. D., Ciardi, A., Chittenden, J. P., Clayson, T., Crilly, A. J., Eardley, S. J., Marrow, K., Russell, D. R., Smith, R. A., Suttle, L. G., Tubman, E. R., **Valenzuela-Villaseca, V.**, Varnish, T. W. O., and Lebedev, S. V., *Radiative cooling effects on reverse shocks formed by magnetised supersonic plasma flows*. Physics of Plasmas 30, 092102. https://doi.org/10.1063/5.0160809

7. 2022 Russell, D. R., Burdiak, G. C., Carroll-Nellenback, Halliday, J. W. D., Hare, J. D., Merlini, S., Smith, R. A., Suttle, L. G., **Valenzuela-Villaseca, V**, J. J., Eardley, S. J, Fullalove, J. A., Rowland, G. C., Smith, R. A., Frank, A., Hartigan, P., Velikovich, A. L., Lebedev, S. V., *Perpendicular Subcritical Shock Structure in a Collisional Plasma Experiment*. Physical Review Letters 129, 225001 https://doi.org/10.1103/PhysRevLett.129.225001

6. 2022 Halliday, J. W. D., Crilly, A., Chittenden J. P., Mancini, R., Merlini, S., Rose, S., Russell, D. R., Suttle, L. G., **Valenzuela-Villaseca, V.**, Bland, S. N., and Lebedev, S. V., *Investigating Radiatively Driven, Magnetised Plasmas with a University Scale Pulsed-Power Generator (invited)*. Physics of Plasmas, 29, 042107 https://doi.org/10.1063/5.0084550

5. 2021 Suttle, L. G., Hare, J. D., Halliday, J. W. D., Merlini, S., Russell, D. R., Tubman, E. R., **Valenzuela-Villaseca, V**, Rozmus, W, Bruulsema, C, Lebedev, S. V., *Collective optical Thomson scattering in pulsed-power driven high energy density physics experiments (invited)*. Review of Scientific Instruments, 92, 033542. https://doi.org/10.1063/5.0041118

4. 2020 Veloso, F., Muñoz-Cordovez, G., Diaz-Droguett, D., **Valenzuela-Villaseca**, V., Vescovi, M., Bhuyan, H., Favre, M., *Axial outflows from conical wire array z-pinches as a tool for surface modifications*. Results in Physics, 19, 103528. https://doi.org/10.1016/j.rinp.2020.103528

3. 2018 Muñoz-Cordovez, G., Veloso, F., **Valenzuela-Villaseca, V.**, Vescovi, M., Useche, W., Wyndham, E., Favre, M., *Emission of fast ions from conical wire array Z-pinches studied at different background pressures*. Physics of Plasmas, 25), 102101. https://doi.org/10.1063/1.5045215

2. 2016 Valdivia, M. P., Stutman, D., Stoeckl, C., Mileham, C., Begischev, I., Theobald, W., Bromage, J., Regan, S. P., Klein, S. R., Muñoz-Codovez, G., Vescovi, M., **Valenzuela-Villaseca, V.**, Veloso, F., *Talbot-Lau x-ray deflectometer electron density diagnostic for laser and pulsed power high energy density plasma experiments*. Review of Scientific Instruments, 87, 11D501. https://doi.org/10.1063/1.4959158

1. 2015 Veloso, F., Muñoz-Cordovez, G., Donoso-Tapia, L., **Valenzuela-Villaseca, V.**, Suzuki-Vidal, F., Swadling, G., Chittenden, J. P., Favre, M., Wyndham, E., *Ablation dynamics in wire array Z-pinches under modifications on global magnetic field topology*. Physics of Plasmas, 22, 072509. https://doi.org/10.1063/1.4926581

Working Publications and Preprints

Five working publications, of which two as first-author.

In preparation	**Valenzuela-Villaseca, V.**, Bhelande,V., Foo, B., Heuer, P., Malko, S., Chen, L., -J, Pongkitiwanichakul, P., Fiksel, G., Fox, W., Schaeffer, D. B., *Laboratory evidence of anomalous electron heating in magnetized quasi-perpendicular collisionless shocks*. To be submitted to Physical Review Letters.
In preparation	**Valenzuela-Villaseca, V.**, Walsh, C. A., Bailly-Grandvaux, M., Blackman, E. G., Swadling, G. F., Suzuki-Vidal, F. *Formation of high-Pm, quasi-Keplerian, differentially rotating plasma flows driven by lasers*. To be submitted to Physical Review Letters.
Submitted	Izquierdo, L., Veloso, F., Escalona, M., **Valenzuela-Villaseca, V.**, Avaria, G., Valenzuela, J. C. *Influence of conical wire array geometry on flow and temperature profiles measured via Thomson scattering and optical techniques*. In review at Physical Review E.`https://arxiv.org/abs/2507.05652`
In preparation	Merlini, S., Beattie, J. R., & **Valenzuela-Villaseca, V.** *The generation of shock-driven turbulence formed from colliding supersonic plasma flows*. To be submitted to The Astrophysical Journal.
In preparation	McCluskey, B. P., Griff-McMahon, J., Haberberger, D., **Valenzuela-Villaseca, V.**, Landsberger, H., Fox, W., *Imaging of plasma density using angular filter refractometry and a fast marching Eikonal solver*. To be submitted to Review of Scientific Instruments.

Selected Conference Contributions

Mar. 2025	International Workshop of Supernova Remnant Physics in the Lab, Lorentz Center, Leiden, Holland (Talk)
Jan. 2025	Latin American Workshop on Plasma Physics, Santiago, Chile (Talk)
Oct. 2024	APS Division of Plasma Physics Annual Meeting, Atlanta GA, USA. (Poster and Invited Talk)
Aug. 2024	International Workshop on the Interrelationship between Plasma Experiments in the Laboratory and in Space (IPELS-16), Garching, Germany. (Poster)
Jul. 2024	EPS Plasma Physics Division Conference, Salamanca, Spain. (Talk)
May 2024	International Conference on High Energy Density Laboratory Astrophysics (HEDLA), Tallahassee FL, USA. (Poster and Invited Talk)
Feb. 2024	National Ignition Facility Users Group Meeting, Livermore CA, USA. (Poster)
Nov. 2023	APS Division of Plasma Physics Annual Meeting, Denver CO, USA. (Talk)
Nov. 2022	APS Division of Plasma Physics Annual Meeting, Spokane WA, USA. (Talk)
Nov. 2021	APS Division of Plasma Physics Annual Meeting, Pittsburgh PA, USA. (Talk)
Apr. 2021	Plasma Physics Conference, Institute of Physics, Virtual. (Talk)
Nov. 2020	APS Division of Plasma Physics Annual Meeting, Virtual. (Talk)
Nov. 2019	APS Division of Plasma Physics Annual Meeting, Fort Lauderdale FL, USA. (Talk)
Jul. 2019	HEDS Summer School, San Diego CA, USA. (Poster)
Nov. 2018	APS Division of Plasma Physics Annual Meeting, Portland OR, USA. (Poster)
Nov. 2016	Joint IAEA-ICTP College on Plasma Physics, Trieste, Italy. (Poster)
Nov. 2016	Annual Chilean Physics Symposium, Santiago, Chile. (Poster)
Oct. 2014	National Physics and Astronomy Student Symposium, Valparaiso, Chile. (Talk)

In the Press & Media

My research and expertise have attracted the attention from news outlets, featuring articles in numerous languages. Selected examples are listed below.

Oct. 2024 **Laboratory for Laser Energetics.** Quick Shot article *OMEGA 60-Beam Laser System Helps Shed Light onto Black Hole Accretion Disks*.

Oct. 2024 **American Physical Society, Division of Plasma Physics**. Press release *Closer to the Horizon: Laser and Pulsed-Power Experiments Emulate Black Hole Accretion Disks*.

Sep. 2023 **Scientific American**. Comment on article *Supermassive Black Hole Feeding Frenzies May Explain Blinking Quasars* by Stephanie Pappas.

Oct. 2023 **The Times**. Related article *Blast off simulator in London recreating the birth of stars* by Niall Jeffrey.

May 2023 **Imperial College London**. Press Release *Shining ring around black holes recreated in the lab*, by Hayley Dunning.

May 2023 **Tendencias 21**. Featured article *Se puede observar lo que pasa en el universo sin salir de casa* by Eduardo Martinez.

Nationality and Visa Status

- Chilean national
- Current visa status: US J1 Research Scholar Visa (valid until Sept. 30 2027).