David Pinto Ramos

ACADEMIC CURRICULUM VITAE

Theoretical physicist | Nonlinear dynamics | Pattern formation | Complex systems
Center for Advanced Systems Understanding (CASUS-HZDR) | Görlitz, Germany
d.pinto-ramos@hzdr.de | ORCID 0000-0002-6558-8891 | Google Scholar | Web of Science

Research Profile

I am a theoretical physicist working on nonlinear dynamics and pattern formation in spatially extended systems. I study how broken spatial symmetries, nonreciprocal interactions, transport, heterogeneity, and fluctuations shape collective dynamics, using bifurcation and stability analysis alongside numerical simulations of continuum and stochastic models. Population dynamics of plants in drylands are my principal application, with related work on discrete, optical, and other dissipative systems.

Academic Positions

2024-present **Postdoctoral Researcher** | Dynamics of Complex Living Systems, CASUS-HZDR | Germany
Developing mathematical and computational models of spatial systems under broken symmetries, nonreciprocal transport, environmental heterogeneity, and stochastic forcing, with ecohydrology as the principal application.

2021 **Visiting Researcher** | Université libre de Bruxelles | Belgium
Analysed multispectral vegetation-pattern imagery and developed a theoretical framework for heterogeneous landscapes. The collaboration has produced 3 peer-reviewed articles and 1 manuscript under review.

2017-2022 **Teaching Assistant** | Universidad de Chile | Chile

Education and Training

03/2019-12/2023 **Doctor of Science in Physics** | Universidad de Chile

03/2015-12/2018 **Bachelor of Science in Physics** | Universidad de Chile

Awards and Honors

2026 **Doctoral Thesis Award (Exact Sciences)** | Academia Chilena de Ciencias (Chilean Academy of Sciences)

2025 **Seal of Excellence** | European Commission, Horizon Europe Marie Skłodowska-Curie Actions (MSCA) | RealVegPACE proposal

2024 **Outstanding PhD Thesis Award** | Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile

Research Funding and Competitive Fellowships

2020-2023 **ANID National PhD Scholarship** | individual doctoral fellowship; sole named recipient

2022 **ANID Operational Costs Funds** | individual research award; sole named recipient

2021 **Wallonie-Bruxelles International Research Internship Grant** | individual mobility grant; sole named recipient

2019 **Millennium Institute for Research in Optics PhD Scholarship** | individual doctoral scholarship; sole named recipient

Research Supervision

04/2026-09/2026 **Supervisor** | CASUS Scultetus Young Researcher Fellowship
Supervised Roza Shahmohammadnejad, the fellowship awardee, in a six-month paid research-assistant project developing a unified mechanistic theory of migrating and stationary banded vegetation patterns.

2024-2026 **Supervisor** | HZDR Summer Student Program
Supervised 3 Master's summer research projects on topography-driven resource flows, stochastic wind-driven seed dispersal, and remote-sensing characterization of vegetation-cover morphology.

2022-2023 **Co-supervisor** | Undergraduate Summer Projects, Universidad de Chile
Co-supervised 4 undergraduate research projects in nonlinear dynamics and pattern formation.

Teaching Experience

2017-2022 **Teaching Assistant** | Universidad de Chile
Fourteen semester appointments across Thermodynamics (4), Classical Mechanics (3), Electromagnetism (2), Statistical Mechanics (2), Mechanics (1), Linear Algebra (1), and Ordinary Differential Equations (1).

Selected Invited Scientific Talks

04/2026 **How spatial patterns can lead to less resilient ecosystems** | Modelling Population Dynamics in Ecology and Evolution, United Kingdom

01/2026 **How spatial patterns can lead to less resilient ecosystems** | Modelling Diffusive Systems: Theory and Biological Applications, Austria

08/2024 **Vegetation banded patterns and their dislocations** | Dynamics Days Europe, Germany

07/2024 **Topological defect law for migrating banded vegetation patterns** | 13th European Conference on Mathematical and Theoretical Biology, Spain

12/2023 **Vegetation banded patterns and their dislocations** | International Workshop on Instabilities and Nonequilibrium Structures, Chile

Academic Service

80 reviews **Peer reviewer** | 80 verified reviews for journals in nonlinear science, applied mathematics, theoretical physics, and ecology

List of Publications

*Reverse chronological order. † corresponding author; * equal contribution.*

Peer-reviewed Journal Articles

1. M. Bongestab, **D. Pinto-Ramos**, and R. Martinez-Garcia, Self-organized vegetation patterns promote persistence of plant–pollinator mutualisms under environmental stress, **PLOS Ecosystems 1**, e0000021 (2026).
2. **D. Pinto-Ramos** and R. Martinez-Garcia. *How spatial patterns can lead to less resilient ecosystems*. **Proceedings of the National Academy of Sciences 123**(14), e2511994123 (2026).
3. **D. Pinto-Ramos**†, M. G. Clerc, A. Makhoute, and M. Tlidi. *Aperiodic clustered and periodic hexagonal vegetation spot arrays explained by inhomogeneous environments and climate trends in arid ecosystems*. **Geophysical Research Letters 52**(21), e2025GL118462 (2025).
4. A. Surendran*, **D. Pinto-Ramos***, R. Menezes*, and R. Martinez-Garcia. *Spatial moment dynamics and biomass density equations provide complementary, yet limited, descriptions of pattern formation in individual-based simulations*. **Physica D: Nonlinear Phenomena 477**, 134703 (2025).
5. **D. Pinto-Ramos**†. *Exact expression for the propagating front velocity in nonlinear discrete systems under nonreciprocal coupling*. **Physica D: Nonlinear Phenomena 476**, 134665 (2025).
6. **D. Pinto-Ramos**†, K. Alfaro-Bittner, R. Rojas, and M. G. Clerc. *Noise-induced nonreciprocal topological dissipative solitons in directionally coupled chains and lattices*. **Nonlinear Dynamics 113**(12), 15321-15333 (2025).
7. P. Aguilera-Rojas, K. Alfaro-Bittner, M. G. Clerc, M. Diaz-Zuñiga, A. Moya, **D. Pinto-Ramos**, and R. Rojas. *Nonlinear wave propagation in a bistable optical chain with nonreciprocal coupling*. **Communications Physics 7**(1), 195 (2024).
8. B. Hidalgo-Ogalde, **D. Pinto-Ramos**, M. Tlidi, and M. G. Clerc. *Nonreciprocal feedback induces migrating oblique and horizontal banded vegetation patterns in hyperarid landscapes*. **Scientific Reports 14**(1), 14635 (2024).
9. M. Tlidi, M. Messaoudi, A. Makhoute, **D. Pinto-Ramos**, and M. G. Clerc. *Non-linear and non-local plant-plant interactions in arid climate: Allometry, criticality and desertification*. **Chaos, Solitons & Fractals 178**, 114311 (2024).
10. **D. Pinto-Ramos**†, K. Alfaro-Bittner, R. Rojas, and M. G. Clerc. *Giant boundary layer induced by nonreciprocal coupling in discrete systems*. **Communications in Nonlinear Science and Numerical Simulation 125**, 107391 (2023).
11. **D. Pinto-Ramos**†, M. G. Clerc, and M. Tlidi. *Topological defect law for migrating banded vegetation patterns in arid climates*. **Science Advances 9**(31), eadf6620 (2023).
12. S. Echeverría-Alar, **D. Pinto-Ramos**, M. Tlidi, and M. G. Clerc. *Effect of heterogeneous environmental conditions on labyrinthine vegetation patterns*. **Physical Review E 107**(5), 054219 (2023).
13. **D. Pinto-Ramos**†, S. Echeverría-Alar, M. Tlidi, and M. G. Clerc. *Vegetation covers phase separation in inhomogeneous environments*. **Chaos, Solitons & Fractals 163**, 112518 (2022).
14. **D. Pinto-Ramos**†, K. Alfaro-Bittner, M. G. Clerc, and R. Rojas. *Nonreciprocal coupling induced self-assembled localized structures*. **Physical Review Letters 126**(19), 194102 (2021).
15. M. Messaoudi, M. G. Clerc, E. Berríos-Caro, **D. Pinto-Ramos**, M. Khaffou, A. Makhoute, and M. Tlidi. *Patchy landscapes in arid environments: Nonlinear analysis of the interaction-redistribution model*. **Chaos: An Interdisciplinary Journal of Nonlinear Science 30**(9), 093136 (2020).

Book Chapters

1. E. Aguilera, M. G. Clerc, **D. Pinto-Ramos**, and V. Zambra. *Thermal fluctuations induced emergence of umbilical defects in nematic liquid crystal cells*. In L. Brenig, N. Brilliantov, and M. Tlidi (Eds.), **Nonequilibrium Thermodynamics and Fluctuation Kinetics**, Fundamental Theories of Physics, vol. 208. Springer, Cham (2022).

Preprints and Submitted Manuscripts

1. **D. Pinto-Ramos**, A. Surendran, and R. Martinez-Garcia. *Higher-Order Competition as a Minimal Mechanism for Spatial Pattern Diversity in Population Dynamics* (2026).
2. **D. Pinto-Ramos**†, M. G. Clerc, A. Makhoute, and M. Tlidi. *Global remote sensing reveals vegetation clustering as a physical footprint of shifting aridity trends in drylands*. arXiv:2604.22122 (2026). Under review.
3. E. A. Droguett-Mora, M. Tlidi, P. Aguilera-Rojas, M. G. Clerc, and **D. Pinto-Ramos**†. *Universal scaling law for topological defects induced by nonreciprocal feedback*. (2026). Under review.