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Specialized in nanoscale light, sound, and matter interactions, I'm a theoretical physicist with a background in both classical and quantum many-body systems. My skills include strong analytical abilities and extensive computational modeling. My work, previously supported by an ETH Postdoctoral Fellowship, is marked by close collaboration with experimental teams. I have experience as a former theory Postdoc in the Photonic Forces experimental group (AMOLF, Amsterdam), focusing on topological and nano-optomechanical networks. Ph.D. thesis devoted to strong light-matter interactions with organic molecules (UAM, Madrid).

Education and Research Experience

Since October 2023 – **University of Konstanz**: Interim Professor (W2 Professurvertretung)

May 2021 – Sept. 2023 **Institute for Theoretical Physics | ETH Zürich**: ETH Post-doctoral Fellow [[details](#)]
Host PIs: Prof. Dr. Oded Zilberberg and Prof. Dr. Christian Degen

Oct. 2018 – Apr. 2021 **AMOLF | Amsterdam**: Post-doctoral Researcher.
PI: Prof. Dr. Ewold Verhagen
Awarded Seal of Excellence from European Commission (H2020-MSCA-IF-2020) [[details](#)]

Sept. 2018 **Universidad Autónoma de Madrid**: Ph. D. degree Physics.
Awarded with distinction Cum Laude. [[Dissertation](#)]
Awarded with Extraordinary Doctoral mention - Thesis prize [[details](#)]
Advisors: Prof. Dr. F.J. García-Vidal, Dr. Johannes Feist.

Oct. – Dec 2016 **University of Cambridge**: Visiting Research Fellow.
Awarded grant from European Cooperation in Science and Technology (ECOST-STSM-MP1403-031016-080502) - Host: Dr. Alex W. Chin.

2012-13 **U. Complutense de Madrid**: M. Sc. Fundamental Physics (EQF level 7).

2007-12 **Universidad Autónoma de Madrid**: 5-yr B. Sc. Physics (EQF level 7).

Peer-reviewed accepted publications (sorted by most recent)

15. Wanjura, C.*, Slim, J. J.*, **del Pino, J.**, Brunelli, M., Verhagen, E. and Nunnenkamp A. (2023). Quadrature non-reciprocity in bosonic networks without breaking time-reversal symmetry (*equal contribution) [[Nature Physics 1-8](#)]
14. **del Pino, J.** and Zilberberg, O. (2022). Dynamical gauge fields with bosonic codes [[Phys. Rev. Lett. 130, 171901](#)]
13. Margiani, G., **del Pino, J.**, Heugel, T. L., Bousse, Nicholas E., Guerrero, S., Kenny, T.W., Zilberberg, O., Sabonis, D., Eichler, A. (2023). Deterministic and stochastic sampling of two coupled Kerr parametric oscillators [[Phys. Rev. Research 5 \(1\), L012029](#)]
12. Kořata, Jan*, **del Pino, J.***, Heugel, Toni L. and Zilberberg, O. (2022). HarmonicBalance.jl: a Julia suite for interacting nonlinear dynamics. (*equal contribution) [[Scipost Codebases 6](#)]
11. **del Pino, J.***, Slim, Jesse J.* and Verhagen, E. (2022). Non-Hermitian chiral phononics through optomechanically-induced squeezing. (*equal contribution) - [[Nature 606, pages 82-87](#)]
10. Burgwal, R., **del Pino, J.** and Verhagen, E. (2020). Comparing nonlinear optomechanical coupling in membrane-in-the-middle and single-cavity optomechanical systems [[New Journal of Physics, Volume 22 113006, November 2020](#)]

9. Silva, R.E.F., **del Pino, J.**, García-Vidal, F. J. and Feist, J. (2020). Polaritonic Molecular Clock: All-Optical Ultrafast Imaging of Wavepacket Dynamics without Probe Pulses- [[Nature Communications volume 11, Article number: 1423](#)]
8. Mathew J. P.* , **del Pino, J.*** , Verhagen E. (2020). Synthetic gauge fields for phonon transport in a nano-optomechanical system (*equal contribution) - [[Nature Nanotechnology volume 15, pages 198 - 202](#)]. Cover selected for Nature Nanotech.; [Volume 15 Issue 3, March 2020](#)
7. Duggan, R.*, **del Pino, J.***, Verhagen, E., Alù A. (2019). Optomechanically Induced Birefringence and Faraday Effect (*equal contribution) - [[Phys. Rev. Lett. 123, 023602](#)]
6. **del Pino, J.**, Schröder, F., Chin, A.W., Feist J., and Garcia-Vidal, F. J. (2018). Tensor Network simulation of non-Markovian dynamics in organic polaritons - [[Phys. Rev. Lett. 121, 227401](#)]
5. **del Pino, J.**, Schröder, F., Chin, A.W., Feist J., and Garcia-Vidal, F. J. (2018). Tensor Network simulation of polaron-polaritons in organic microcavities - [[Phys. Rev. B 98, 165416](#)]
4. **del Pino, J.**, Feist, J., and Garcia-Vidal, F. J. (2016). Exploiting Vibrational Strong Coupling to make an Optical Parametric Oscillator out of a Raman Laser. [[Phys. Rev. Lett. 117 \(27\), 277401](#)]
3. **del Pino, J.**, Feist, J., and Garcia-Vidal, F. J. (2015). Signatures of Vibrational Strong Coupling in Raman Scattering. [[J. Phys. Chem. C, 2015, 119 \(52\)](#)]
2. **del Pino, J.**, Feist, J., and Garcia-Vidal, F. J. (2015). Quantum theory of collective strong coupling of molecular vibrations with a microcavity mode. [[New Journal of Physics 17 053040](#)] (Highlighted: Ensemble strong coupling - W. L. Barnes (2015). NJP 17 081001).
1. **del Pino, J.**, Feist, J., García-Vidal, F. J., and García-Ripoll, J. J. (2014). Entanglement detection in coupled particle plasmons. [[Phys. Rev. Lett. 112 \(21\), 216805](#)]

Preprints under review

- PR5. Visani, Diego A., Catalini, Letizia, Degen, Christian L., Eichler, Alexander, **del Pino, J.** (2023) Near-resonant nuclear spin detection with high-frequency mechanical resonators [[arXiv:2311.16273](#)]
- PR4. Slim, J. J., Wanjura, C., Brunelli, M., **del Pino, J.**, Nunnenkamp A. and Verhagen, E. (2023) Optomechanical realization of the bosonic Kitaev-Majorana chain [[arXiv:2309.05825](#)]
- PR3. **del Pino, J.**, Košata, J., Zilberberg, O. (2023) Limit cycles as stationary states of an extended Harmonic Balance ansatz [[arXiv:2308.06092](#)]
- PR2. Borovik, V., Breiding, P., **del Pino, J.**, Michałek, M., Zilberberg, O. (2023) Khovanskii bases for semimixed systems of polynomial equations—a case of approximating stationary nonlinear Newtonian dynamics [[arXiv:2306.07897](#)] (Accepted in *Journal de Mathématiques Pures et Appliquées*)
- PR1. Álvarez, P., Pittilini, D., Miserocchi, F., Raamamurthy, S., Margiani, G., Ameye, O., **del Pino, J.**, Zilberberg, O., Eichler A. (2023) A biased Ising model using two coupled Kerr parametric oscillators with external force [[arXiv:2307.13676](#)]

Publications in preparation

- Visani, D., Catalini, L., Degen, C., Eichler A. and **del Pino, J.** – Nuclear Spin Detection with High-Frequency Mechanical Resonators
- Schmidt, S., **del Pino, J.**, Soriente, M. and Zilberberg, O. – Many-body phases in the open Kerr-Dicke model
- Kumar, S., **del Pino, J.**, and Zilberberg, O. – Theory of nonlinear pump-nonlinear probe spectroscopy
- Slim, Jesse J.*, **del Pino, J.*** and Verhagen. E. – Chiral thermal flows in an artificial-flux-biased nanomechanical system (*equal contribution)
- Slim, Jesse J.*, **del Pino, J.** and Verhagen. E. - Aharonov-Bohm caging in nanomechanical loops under a synthetic field
- Slim, Jesse J.*, **del Pino, J.*** and Verhagen. E. - Tuneable nonlinear dynamics through synthetic fields

- **del Pino, J.**, Baumgärtner, A., Dreon, Hertlein, S.; Esslinger, T.; Donner, T., Zilberberg, O. – Superradiance and optomechanics in a BEC coupled to two crossed Cavities
- Pernet N., Villa. G, **del Pino, J.**, Ravets. S., Zilberberg, O., Bloch, J. – Spontaneous chiral symmetry breaking in coupled nonlinear microcavities

Teaching experience and student supervision

- ◇ **Lecturer:** Winter Semester 2023, University of Konstanz: Computational Approaches to Quantum Oscillators (Wahlpflichtfach Theorie), Computational Methods for Quantum Optics (Seminare).
- ◇ **Ph. D. candidate co-tutoring (official second advisor [\[details\]](#)):** Diego Visani (ETH Zürich), 2022-26
- ◇ **Ph. D. candidate co-tutoring (unofficial):** **(1)** Jesse Slim (AMOLF, TU/e), Cum-Laude award, 2018-22, **(2)** Jan Kořata (ETH Zürich) 2021-22, **(3)** Greta Villa (University of Konstanz) 2022-26, **(4)** Soumya Kumar (University of Konstanz) 2022-26, **(5)** Orjan Ameye (University of Konstanz) 2022-26.
- ◇ **Bachelor Thesis:** Simon Eggert (University of Konstanz) 2023-24
- ◇ **Teaching assistant (TA). [Year | Duration]**
 - Parametric Phenomena (ETH) as a TA to PD Dr Alexander Eichler.
 - Proseminar Courses on Theoretical Physics (ETH): Nonlinear Dynamical Systems (B. Sc. In Physics), Solitons and Instantons in Condensed Matter (M. Sc. In Theoretical Physics), Riemann Surfaces in Mathematical Physics (M. Sc. In Theoretical Physics).
 - Experimental Techniques I (UAM): B. Sc. in Physics [2017-2018 | 32 h]
 - General Physics laboratory (UAM): B. Sc. in Chemistry [2013-2014 | 21 h], [2014-2015 | 48 h], [2015-2016 | 16 h] and [2016-2017 | 48 h]. Chemical Engineering [2015-2016, 24 h].
- ◇ **Training sessions:** Julia training session on HarmonicBalance.jl, aimed at researchers and students on Parametric Phenomena at ETH Zürich and University of Konstanz (Oct. 2022)
- ◇ **Private tutor:** 1st/2nd year in Physics, Mathematics, Computer Science and Chemistry B. Sc.'s (2010-2014). Python programming (2018-2021).

Additional Awards/merits

- ◇ **Short-listed for Tenure-Track Assistant Professorship at TU Wien**, for a topical position on Complex Photonic Structures at the Institute for Theoretical Physics (2nd in the list).
- ◇ **Granted an ESPRIT fellowship:** from the Austrian Science Fund (FWF) with 316036€ to undergo the 3-year Postdoctoral project "Gauge theories in nonlinear interacting polaritons", mentored by Prof. Stefan Rotter (TU Wien), in collaboration with Prof. Jacqueline Bloch (C2N) [\[details\]](#).
- ◇ **Ramón y Cajal Fellowship 2022:** Evaluated with 95.64/100 (granted above 96.56/100) [\[details\]](#).
- ◇ **Invited to** Global Young Scientists Summit 2021 [\[details\]](#)
- ◇ **Predocutorial Assistant Professor position:** (Ayudante Universidad LOU (020020060)) Department of Theoretical Condensed Matter Physics UAM - Awarded in Open Competition
- ◇ **Collaboration fellowship** (2011-2012) for Introduction to Research. Title: "Spin dynamics in artificial triatomic molecules". Host: Gloria Platero (Material Science Institute (ICMM) - CSIC)

Computer skills and open-source projects

- ◇ **Core developer of HarmonicBalance.jl** | Julia package for solving nonlinear differential equations using the method of Harmonic Balance [\[GitHub repository\]](#)
- ◇ **Scientific Computing:** Programming Languages: Python (Most used), Julia (2nd most used), MATLAB, Mathematica. Intermediate skills in: Shell Script, R, Fortran, C.
- ◇ **Simulations in large-scale cluster:** Plasmonq cluster from Nanophotonics Group (UAM), SURF-sara (Science Park), Rick and Morty High-Performance Computers from QUEST group (ETH).
- ◇ Other: Git Workflow, LATEX, Office Suite, Inkscape, Photoshop, Blender

Outreach

- ◇ **Contributed to 36 conferences** (5 invited talks, 6 contributed talks)
- ◇ **Organization of Scientific events:**

- **Workshop on Parametric Phenomena** (11-13 January 2023) [[webpage](#)]
- Konstanz University. Networking event for Theoretical Physics Groups (*Get 2 know your neighbor*, 2021)
- **Online Seminar Series on Non-Hermitian Physics** (from 17th May 2023) [[webpage](#)]
- **Theory Colloquium at the University of Konstanz** (from 13th November 2023) [[webpage](#)]

◇ **General public engagement (PR = Press release)**

- **PR:** AMOLF [[Engineering dual carriageways for signals \(2023\)](#)]
- **PR:** AMOLF [[Discovery of new mechanisms to control the flow of sound \(2022\)](#)]
- **PR:** Department of Theoretical Condensed Matter Physics (UAM) [[Exploiting vibrational strong coupling to make an optical parametric oscillator out of a Raman laser \(2017\)](#)],
- **PR:** Department of Theoretical Condensed Matter Physics (UAM) [[Polaritonic molecular clock listening to molecules \(2020\)](#)]
- **PR:** AMOLF [[Using light to couple the strings of a nanoscopic guitar \(2020\)](#)]
- Open Day Amsterdam Science Park [[details](#)] (2 in-person events aimed for kids 2018-2019)

Commission of trust and other activities

- ◇ **Evaluating panel of ETH Zurich Career Seed Awards**, which are aimed to provide early-stage postdocs with a funding opportunity for stand-alone research projects over a year [[details](#)].
- ◇ **Reviewer** for Nature Physics, Physical Review A, Physical Review B, Physical Review Letters, Applied Physics Letters, NPJ Quantum Materials, Entropy, Journal of Applied Physics, and Annalen der Physik
- ◇ **Hosted Scientific visits at ETH/seminar organization:** Antonio Štrkalj (University of Cambridge), Sebastian Schmid (University of Strathclyde), Julian Lenz (Swansea University), Matteo Brunelli (University of Basel).
- ◇ **Informal Colloquia:** Dep. of Theoretical Condensed Matter Physics UAM (3 given, invited for 1 online), AMOLF (3 given)
- ◇ **Mathematics degree** (up to 3rd year). National University of Distance Education (UNED)
- ◇ **Deep Learning specialization (MOOC)** | deeplearning.ai (2020)
Structuring Machine Learning projects [[certificate](#)], Improving Deep Neural Networks [[certificate](#)], Neural Networks and Deep Learning [[certificate](#)], Convolutional Neural Networks [[certificate](#)], Sequence Models [[certificate](#)]
- ◇ **Big Data specialization (MOOC)** | University of California, San Diego (2016-17)
Big Data Modelling and Management Systems: [[certificate](#)], Introduction to Big Data [[certificate](#)]
MOOC Statistical Mechanics: Algorithms and Computations - École normale supérieure

Language skills

- ◇ **Spanish:** Native
- ◇ **English:** Fluent - IELTS - Overall Band Score 7.0 (CEFR Level C1)
- ◇ **Portuguese:** Basic professional skills

Participation in International Projects (not as a PI)

- ◇ **2 European projects** as a PhD Student (ERC Advanced Grant "PLASMONANOQUANTA" with P.I. Francisco José García Vidal, UAM), and as a Postdoc (ERC Starting Grant "TOPP" with P.I. Ewold Verhagen, AMOLF)

Conference Contributions [Type: Contributed/Invited Talk (CT, IT), Poster (P)]

- ◇ **TU Wien, Institute for Theoretical Physics (IT):** "Controlling Light and Sound in Complex Structures with Engineered Gauge Fields" [*April 2023*]

- ◇ **Laboratorio de Fotónica y Optoelectrónica del Centro Atómico de Bariloche (IT):** "Solving nonlinear dynamics using HarmonicBalance.jl" [November 2022]
- ◇ **(TTQM2022) Trends in the Theory of Quantum Materials 2022 (P):** "From chiral squeezing to nonlinear topology in optomechanics".
- ◇ **Laboratorio de Fotónica y Optoelectrónica del Centro Atómico de Bariloche (IT):** "Desde el 'squeezing' quiral a la topología no lineal en optomecánica" [October 2022]
- ◇ **CMD29 – mini colloquium of Nanomechanical and Electromechanical systems (IT):** "Synthetic magnetic fields for Hermitian and non-Hermitian topologically-protected states in nano-optomechanical arrays."
- ◇ **International Conference on Complexity and Topology in Quantum Matter (CT.QMAT22) (CT):** "From chiral squeezing to nonlinear topological phases in optomechanics."
- ◇ **Quantum Science: Implementations** (session organization and discussion leader)
- ◇ **QSIT Monte Verità '22 (P):** "From chiral squeezing to nonlinear topological phases in optomechanics."
- ◇ **TU Wien, Institute for Theoretical Physics (IT):** "From chiral squeezing to nonlinear topological phases in optomechanics." [June 2022]
- ◇ **NanoMRI 7 (P):** "Low-noise spin Detection enabled by coherent nanomechanical coupling".
- ◇ **QSIT General Meeting & Winter School (IT):** "From chiral squeezing to nonlinear topological phases in optomechanics".
- ◇ **QSIT General Meeting & Winter School (P):** "Floquet Engineering on semiclassical and quantum nonlinear systems."
- ◇ **Mathematics Department oberseminare, Universität Konstanz (IT):** "The physics of nonlinear systems with homotopy continuation."
- ◇ **SFB 1432 Retreat, Universität Konstanz (P):** "Charting solution landscapes in nonlinear driven-dissipative networks."
- ◇ **Condensed Matter Physics Department UAM (IT):** "Sound with a twist: synthetic magnetic fields for phonons in nano-optomechanical networks."
- ◇ **Quantum Nanophotonics Benasque 2021 - (CT):** "Synthetic magnetic fields for topologically-protected sound in nano-optomechanical arrays."
- ◇ **ETHz, NCCR QSIT Seminar - (IT):** "Synthetic magnetic fields for Hermitian and non-Hermitian topologically protected states in nano optomechanical arrays."
- ◇ **(Accepted Contribution but Cancelled) Topological Matter Conference (2020) - (CT):** "Synthetic magnetic fields for topologically-protected sound in nano-optomechanical arrays."
- ◇ **(Accepted Contribution but Cancelled) Gordon Research Conference on Mechanical Systems in the Quantum Regime (2020) - (P):** "Hermitian and non-Hermitian topological states in optomechanically-coupled nanomechanical modes in the Doppler limit."
- ◇ **(Accepted Contribution but Cancelled) Gordon Research Seminar on Mechanical Systems in the Quantum Regime (2020) - (CT):** "Synthetic magnetic fields for Hermitian and non-Hermitian topologically-protected states in nano-optomechanical arrays."
- ◇ **OSA Advanced Photonics Congress 2019 - (IT):** "Synthetic magnetic fields for phonons and photons through optomechanical interactions."
- ◇ **DIEP "Workshop on Topology and broken symmetries 2019" - (P):** "Synthetic gauge fields for phonon transport along spatial and synthetic dimensions in a nano-optomechanical system".
- ◇ **AMOLF International Nanophotonics School 2019 - (P):** "Synthetic gauge fields for phonon transport in a nano-optomechanical system."
- ◇ **AMOLF Klein Colloquium- (IT):** "Optomechanically induced birefringence and Faraday effect."
- ◇ **CLEO US 2019 conference - (CT):** "Dynamical gauge fields for phonons in an optomechanical system."
- ◇ **Hybrid Optomechanical Technologies (HOT) annual meeting 2019 - (P):** "Synthetic gauge fields for phonon transport in a nano-optomechanical system."

- ◇ **AMOLF- (IT):** "Vibrational and electronic strong light-matter coupling with molecular excitations."
- ◇ **TU Eindhoven- (IT):** "Trap 1 photon and many molecules in a box and let the music play: Some examples of strong coupling with molecular excitations."
- ◇ **SCOM Workshop 2018 - (P):** "Tensor network simulation of non-Markovian dynamics in organic polaritons."
- ◇ **Conference on Quantum Nanophotonics 2017 - (P):** "Investigating multi-mode vibrational model for organic polaritonic chemistry: nuclear and environmental effects."
- ◇ **Quantum Nanophotonics 2017 - (P):** "Exploiting Vibrational Strong Coupling to make an Optical Parametric Oscillator out of a Raman Laser."
- ◇ **SCOM Workshop 2016 - (P):** "Exploiting Vibrational Strong Coupling to make an Optical Parametric Oscillator out of a Raman Laser."
- ◇ **COST MP1403, NQO ESR Workshop 2015 - (CT):** "Signatures of Vibrational Strong Coupling in Raman Scattering."
- ◇ **SPP7 (2015)- (P):** "Quantum theory of collective strong coupling of molecular vibrations with a microcavity mode."
- ◇ **Quantum Plasmonics 2015 - (P):** "Quantum theory of collective strong coupling of molecular vibrations with a microcavity mode."
- ◇ **INC Young Researchers Meeting XVII - (CT):** "Entanglement detection in coupled particle plasmons."
- ◇ **Photon '14 - (P):** "Entanglement detection in coupled particle plasmons."
- ◇ **Nanolight 2014 - (P):** "Entanglement detection in coupled plasmons."
- ◇ **INC Young Researchers Meeting XVI - (P):** "Entangling localised plasmons in nanoparticle arrays."