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I am an Interim Professor in Theoretical Quantum Physics. My research focuses on using artificial platforms to study complex, many-body phenomena in light, sound, and matter, relevant to energy, computing, and quantum technologies. My expertise is at the crossroads of quantum optics, optomechanics, and classical nonlinear dynamics. I usually develop advanced analytical tools and software, like [HarmonicBalance.jl](#). I collaborate with high-profile experimental groups. My research is published in journals like Nature and Physical Review Letters, and I have received honors including an ETH Postdoctoral Fellow and a Ph.D. Extraordinary Thesis Prize.

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.

Sept. 2012- June 2013 [U. Complutense de Madrid](#): M. Sc. Fundamental Physics (EQF level 7).

2007-2012 [Universidad Autónoma de Madrid](#): 5-yr B. Sc. Physics (EQF level 7).

Peer-reviewed accepted publications (sorted by most recent)

17. Slim, J. J., Wanjura, C., Brunelli, M., **del Pino, J.**, Nunnenkamp A., Verhagen, E. (2023) Optomechanical realization of the bosonic Kitaev chain [[arXiv:2309.05825](#)] (Nature, in press)

16. 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 [[Journal de Mathématiques Pures et Appliquées](#), **182**, 195-222]

15. Wanjura, C.*, Slim, J. J.*, **del Pino, J.**, Brunelli, M., Verhagen, E., Nunnenkamp A. (2023). Quadrature non-reciprocity in bosonic networks without breaking time-reversal symmetry (*equal contribution) [[Nature Physics](#) **19**(10), 1429-1436]

14. **del Pino, J.**, Zilberberg, O. (2022). Dynamical gauge fields with bosonic codes [[Phys. Rev. Lett.](#) **130**(17), 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., 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\(7912\), 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 11\(1\), 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 15\(3\), 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\(2\), 023602](#)]
6. **del Pino, J.**, Schröder, F., Chin, A.W., Feist J., Garcia-Vidal, F. J. (2018). Tensor Network simulation of non-Markovian dynamics in organic polaritons - [[Phys. Rev. Lett. 121\(22\), 227401](#)]
5. **del Pino, J.**, Schröder, F., Chin, A.W., Feist J., Garcia-Vidal, F. J. (2018). Tensor Network simulation of polaron-polaritons in organic microcavities - [[Phys. Rev. B 98\(16\), 165416](#)]
4. **del Pino, J.**, Feist, J., 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., Garcia-Vidal, F. J. (2015). Signatures of Vibrational Strong Coupling in Raman Scattering. [[J. Phys. Chem. C, 2015, 119\(52\), 29132-29137](#)]
2. **del Pino, J.**, Feist, J., Garcia-Vidal, F. J. (2015). Quantum theory of collective strong coupling of molecular vibrations with a microcavity mode. [[New Journal of Physics 17\(5\), 053040](#)] (Highlighted: Ensemble strong coupling - W. L. Barnes (2015). NJP 17 081001).
1. **del Pino, J.**, Feist, J., García-Vidal, F. J., García-Ripoll, J. J. (2014). Entanglement detection in coupled particle plasmons. [[Phys. Rev. Lett. 112\(21\), 216805](#)]

Preprints under review

- PR.** 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](#)]
- PR.** **del Pino, J.**, Košata, J., Zilberberg, O. (2023) Limit cycles as stationary states of an extended Harmonic Balance ansatz [[arXiv:2308.06092](#)]
- PR.** 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](#)]

Teaching experience and student supervision

- ◇ **Lecturer:** (i) *Winter Semester (2023)*, University of Konstanz: Computational Approaches to Quantum Oscillators (Wahlpflichtfach), Computational Methods for Quantum Optics (Seminare). (ii) *Summer Semester (2024)*, University of Konstanz: Parametric & Many-body Phenomena in Quantum Optics (Wahlpflichtfach). Offered to both MSc and BSc students.
- ◇ **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 Košata (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 [\[details\]](#)
- ◇ **Predocctoral 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 [\[GitHub repository\]](#)
- ◇ **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).

Outreach

- ◇ **Contributed to 40 conferences/seminars** (13 invited talks and seminars, 7 contributed talks)
- ◇ **Organization of Scientific events:**
 - **Workshop on Parametric Phenomena** (11-13 January 2023) [\[webpage\]](#)
 - **Theory Colloquium at the University of Konstanz** (from 13th November 2023) [\[webpage\]](#)
 - **Online Seminar Series on Non-Hermitian Physics** (from 17th May 2023) [\[webpage\]](#)
 - Konstanz University. Networking event for Theoretical Physics Groups (2021)
- ◇ **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 at 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:** Antonio Štrkalj (University of Cambridge), Sebastian Schmid (University of Strathclyde), Julian Lenz (Swansea University), Matteo Brunelli (University of Basel).
- ◇ **Informal Colloquia:** 6 given, at Dep. of Theoretical Condensed Matter Physics UAM & AMOLF
- ◇ **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)]

- ◇ **CSIC, Instituto de Física Fundamental - (IT):** “Chirality and Topology in Optomechanical Networks via Bosonic Squeezing” [January 2024]
- ◇ **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."
- ◇ **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."