CURRICULUM VITAE

Personal Information

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Current position

I am a CNRS full researcher working at the Institute of Nanosciences of Paris (INSP) located in the Sorbonne University, in Paris, France. I moved to the INSP in September 2024, after working at the CNRS laboratory LIMMS placed inside the University of Tokyo, Japan; for a period of 4 years (`http://limms-tokyo.org`). Before moving to Tokyo in August 2020, I worked at the Institute Pprime (`http://www.pprime.fr`) since my CNRS recruitment in October 2015, as chargé de recherche de première classe (now reclassified as chargé de recherche de classe normale (CRCN)).

Research Profile

My research area is the heat transport driven by phonons, photons, and polaritons propagating in nano, micro- and macro-materials with applications in thermopolaritonics and thermotronics (thermal computing), electronics, photonics, thermoelectricity, among others. The Boltzmann transport equation, Maxwell's equations of electromagnetism, and fluctuational electrodynamics are my main tools for theoretically and experimentally studying the heat transport in linear and non-linear materials subjected to steady-state and dynamical conditions. My major contributions are classified in three axes: first, the prediction of new physical effects and the conception of thermal devices, such as the quantization of the polariton thermal conductance in nanowires and nanofilms, the thermal memristor, thermal wave diode, and quantum thermal transistor. Second, the development of analytical models for fitting thermal properties from experimental data recorded by the techniques 3ω, time-domain thermoreflectance, photothermal radiometry, thermal wave resonant cavity, and photoacoustics. Third, the modeling and measurement of the thermal conductivity of composites made up of nanoparticles or porous embedded in a solid matrix. These three research axes have been developed for polar (i. e. SiO_2, SiN, SiC), phase-change (i. e. VO_2, nitinol), and dielectric materials under the form of thin films and wires, mainly.

Education and Formation

Studies/Degrees	Institution	Research topic
HDR* Diploma (03/2020)	Institute Pprime, University of Poitiers (www.pprime.fr)	Thermal phenomena driven by polaritons and VO_2
Postdoctoral fellow (09/2013-10/2015)	Laboratory EM2C, CentraleSupelec (www.centralesupelec.fr)	Heat transport by surface phonon-polaritons
Postdoctoral fellow (09/2011-08/2012)	CINVESTAV**, Merida, Mexico (www.mda.cinvestav.mx)	Thermal characterization of nanocomposites
Ph.D. (09/2008-08/2011)	CINVESTAV, Merida, Mexico (www.mda.cinvestav.mx) and University of Colorado, USA (www.colorado.edu)	Heat conduction in nanomaterials: Beyond the Fourier's law
Master (03/2006-08/2008)	CINVESTAV, Merida, Mexico (www.mda.cinvestav.mx)	Modulated heat propagation in thin films
Bachelor (03/2000-12/2005)	UNJBG***, Tacna, Peru (www.unjbg.edu.pe)	Optimization of solar water heaters

* Habilitation à Diriger de Recherches, ** Centro de Investigación y de Estudios Avanzados, *** Universidad Nacional Jorge Basadre Grohmann.

Awards

2018 : Medal Jorge Basadre, as a prominent researcher graduated from UNJBG, Peru.
2013 : Junior Prize of the IPPA, as an outstanding young researcher, China.
2013 : Prize IIM-UNAM to the best PhD thesis in materials science, Mexico.
2012 : Prize Arturo Rosenblueth to the best PhD thesis in exact sciences, Mexico.
2011 : Award to the Academic Excellence, CINVESTAV, Merida, Mexico.
2010 : Conacyt Scholarship, University of Colorado at Boulder, USA.
2008-2011 : Conacyt Doctoral Scholarship, CINVESTAV, Merida, Mexico.
2006-2008 : Conacyt Master Scholarship, CINVESTAV, Merida, Mexico.
2004 : Criscos Undergraduate Scholarship, University La Serena, Chile.
2000-2004 : 5 awards to the undergraduate student with highest academic scores at UNJBG.

Supervision of PhD Students

- **2016 - 2019**: Codirector of the PhD student Ivan Forero Sandoval, who defended his thesis on August 23, 2019 at Cinvestav, Merida, Mexico.
- **2016 - 2019**: Codirector of the PhD student Kamal Alaili, who defended his thesis in December 2019 at the Institute Pprime, CNRS, France.
- **2018 - 2020**: Codirector of the PhD student Suraju Kasali, who defended his thesis in January 2020 at the Institute Pprime, CNRS, France.
- **2020 - 2023**: Codirector of the PhD student Irving Zapata, who started his thesis in November 2020 at the Institute Pprime, CNRS, France.

Research and Networking Projects

- **Scientific coordinator** of the Kakenhi project titled "*SuperPlanckian radiation via cavity guided waves*" that aims at experimentally quantifying the thermal energy of surface phonon-polaritons propagating along the inner surfaces of macro-sized cavities. This 3-year project (01/04/2023 - 31/03/2026) funded by the Japan Science and Technology Agency is being developed with a budget of **120.4 k€** (`https://kaken.nii.ac.jp/en/grant/KAKENHI-PROJECT-23H01352`).
- **Scientific coordinator** of the ANR-JCJC project titled "*Enhanced energy transport along nanofilms supporting the propagation of polaritons*" that aims at experimentally quantifying the thermal energy of surface phonon-polaritons propagating along nanofilms deposited over substrates. The budget of this 3.5-year project (01/11/2019 - 30/04/2023) is of **223.4 k€** (https://anr.fr/Projet-ANR-19-CE09-0005).
- **Main scientific coordinator** of the regional project titled "*Transistors Thermiques Radiatifs et Conductifs à Base du VO_2*" that aims to experimentally demonstrate the amplification of conductive and radiative heat currents through prototypes of thermal transistors. This 3.5-year project (01/03/2020 - 30/09/2023) involves the partipation of four research groups (Institut Pprime of Poitiers, IRCER of Limoges, and ICMCB and LOMA of Bordeaux) of the region Nouvelle Aquitaine and is being developed with a budget of **394 k€** (https://thermal-transistor-naq.cnrs.fr).
- **Scientific partner** of the CREST project titled "*Two-dimensional heat transport by surface phonon-polaritons*"that aims at theoretically and experimentally studying the thermal energy transport of surface electromagnetic waves propagating along different structures. This two-partner project (LIMMS+University of Tokyo) funded by the Japan Science and Technology Agency is being developed with a budget of **4 M€**, during 4 years, since October 2019.
- **Main proposer** of the COST Action proposal titled "*Nanoscale Heat Transfer and Exploitation*", which involves the active participation of 45 research groups and 3 industrial partners from 20 European countries. This networking project of the European

nanoscale heat transfer community, if funded, will allow the development of networking activities during 4 years with an average budget of **150 k€/year**. The project proposal has been submitted to the COST association on October 29, 2021 and the results of its possible funding will be published on May 30, 2022 (www.cost.eu).

- **Scientific coordinator** of the CNRS-PEPS project "*Détermination Expérimentale de l'Énergie de Phonon-Polaritons de Surface se Propageant le Long de Nano Couches Minces de SiO_2 et SiC*", which was developed in 2017 with a budget of **15 k€**.

- **Participation** in the ANR project CarISOVERRE (https://anr.fr/Projet-ANR-16-CE09-0012) and three European ones: Nanotherm (www.project-nanotherm.com), Nanoteg (www.project-nanoteg.com) and Euphonon (www.phantomsnet.net/EUPHONON).

Scientific Responsibilities

- **Supervisor** of the postdoctoral researcher Ivan Forero Sandoval, who is currently working for 2 years (March 2020 - February 2022) at the institute Pprime, CNRS, France.

- **Host researcher** of the professor Zarko Cojbasic (University of Nis, Serbia , `www.ni.ac.rs/en`), who performed a research stay of fifteen days (November - December 2019) at the institute Pprime, CNRS, France.

- **Host researcher** of the professor Antonio Tiburcio Moreno (UNJBG, Peru, `www.unjbg.edu.pe`), who performed a research stay of three months (January - April 2019) at the institute Pprime, CNRS, France.

- **Host researcher** of Dr. Juan Jose Alvarado-Gil (Cinvestav, Mexico, `www.mda.cinvestav.mx`), who did a sabbatical year (January - Decembre 2018) at the institute Pprime, CNRS, France.

- **Host researcher** of the professors Claudia Hernández Aguilar and Flavio Arturo Domínguez Pacheco (IPN, Mexico, www.ipn.mx), who performed a research stay of one month (November 2018) at the institute Pprime, CNRS, France.

- **Host researcher** of the professor James Hill (University of Adelaide, Australia, `www.adelaide.edu.au`), who performed a research stay of three months (May - July 2017) at the institute Pprime, CNRS, France.

- **Host researcher** of the Ph.D. students Cindy Lorena Gomez-Heredia and Jorge Andres Ramirez-Rincon (Cinvestav,Mexico, www.mda.cinvestav.mx), who performed a research stay of one year (April 2017 - March 2018) at the institute Pprime, CNRS, France.

- **Host researcher** of the undergraduate student Gunther Eugenio Flores Cáceres (UNJBG, Peru, www.unjbg.edu.pe), who performed a research stay of three months (June - August 2016) at the institute Pprime, CNRS, France.

- **Ad hoc reviewer** of more than 30 articles from 15 scientific journals, such as Nature Commun. (1), Scientific Reports (2), PNAS (1), Advanced Science (1), Phys. Rev. Lett. (4), Phys. Rev. B (3), Nanoscale (2), J. Appl. Phys. (7), J. Heat Transport (2), etc.

Participation in Editorial Boards of Scientific Journals

- **Photoacoustics** (Impact factor = 8.5): Member since April 2019.
- **Nanomaterials** (Impact factor = 5.1): Member since November 2019.
- **Journal of Applied Research and Technology**: Member since January 2020.

Languages

- Native language: Spanish.
- Foreign languages: Professional mastery of English and French.

Book

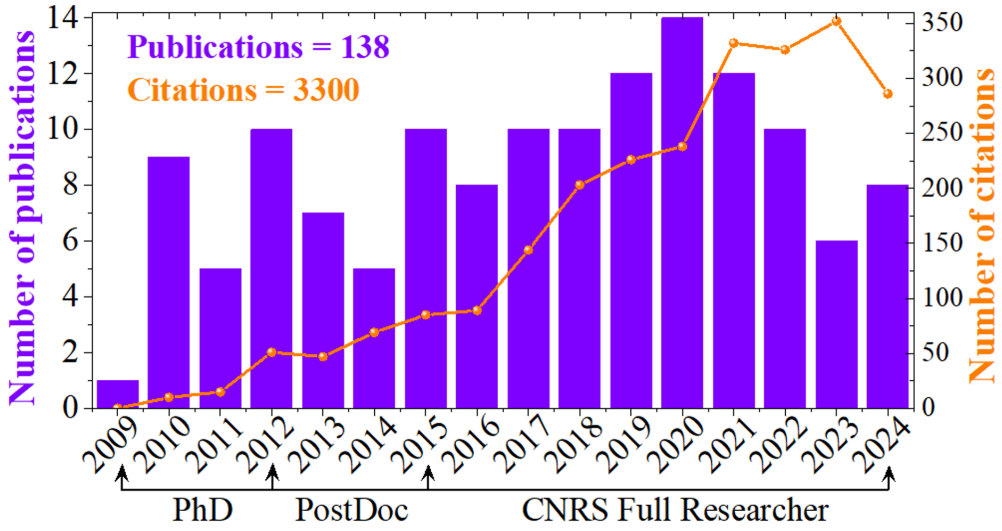
Sebastian Volz and **Jose Ordonez-Miranda**, **Heat Transport Driven by Surface Electromagnetic Waves** published by the editorial house Springer Nature in August 2024.

Book Chapter

J. Ordonez-Miranda, R. Yang, and J. J. Alvarado-Gil, Thermal Conductivity of Particulate Nanocomposites, in **Nanoscale Thermoelectrics** of the Springer series "Lecture Notes on Nanoscale Science and Technology.[ed]ited by Xiaodong Wang and Zhimin Wang.

Metrics

- I have co-written 138 articles published in scientific journals. The full list is on my website www.joseordonez.cnrs.fr.
- **h-index=30**, based on Web of Science (**34**, based on Google Scholar).



7 Main Publications

Publication	Significance
J. Ordonez-Miranda, L. Tranchant, B. Kim, Y. Chalopin, T. Antoni and S. Volz, **Quantized thermal conductance of nanowires at room temperature due to Zenneck surface-phonon polaritons**, Phys. Rev. Lett. 112, 055901 (2014).	Theoretical demonstration of the quantization of the thermal conductance of a polar nanowire supporting the propagation of surface-phonon polaritons. This universal quantization is given by $\pi^2 k_B^2 T/3h (\approx 300$ pW/K at $T = 300$ K), holds not only for temperatures much smaller than 1 K, as is the case for electrons and phonons, but also for temperatures comparable to room temperature, which can significantly facilitate its observation and application.
K. Joulain, J. Drevillon, Y. Ezzahri and J. Ordonez-Miranda, **Quantum thermal transistor**, Phys. Rev. Lett. 116, 200601 (2016). **Editors' Suggestion**.	Theoretical foundation of a quantum thermal transistor able to amplify the variations of heat currents exchanged by three two-level systems coupled to a thermal reservoir each. For the case of three interacting spins, high thermal amplification is obtained in a wide range of energy parameters and temperatures. The proposed quantum transistor is analogous to its electronic bipolar counterpart and hence could be used a thermal amplifier or modulator of quantum systems.
J. Ordonez-Miranda, Y. Ezzahri, J. A. Tiburcio-Moreno, K. Joulain and J. Drevillon, **Radiative thermal memristor**, Phys. Rev. Lett. 123, 025901 (2019). **Editors' Suggestion**.	Proof of principle of a radiative thermal memristor (memory resistor) characterized by a Lissajous curve between the heat flux and temperature difference of its two terminals. This is achieved by capitalizing on the thermal hysteresis and metal-insulator transition of VO_2, which allows to switch on and off the thermal resistance with time. The proposed memristor lays the foundations for the thermal computing with photons due to the analogy to its electronic counterpart.

Publication	Significance
Y. Wu, J. Ordonez-Miranda, S. Gluchko, R. Anufriev, S. Volz and M. Nomura, **Enhanced thermal conduction by surface phonon-polaritons**, Sci. Adv. 6, eabb4461 (2020).	Experimental demonstration of the heat transport by surface phonon-polaritons. Higher in-plane thermal conductivity enhancements are observed for thinner and/or hotter suspended SiN nanofilms, which represents the fingerprints of the polariton thermal contribution. Polaritons can thus be considered as the 4^{th} **heat carrier**, besides phonons, electrons, and photons; able to improve the heat dissipation in microelectronics.
S. Volz, M. Nomura and J. Ordonez-Miranda, **Resonant polariton thermal transport along a vacuum gap**, Phys. Rev. Applied 18, L051003 (2022).	Theoretical foundation of the super-Planckian far-field radiation of a macroscopic cavity supporting the in-plane propagation of surface phonon-polaritons. The maximum polariton thermal conductance along a 1-cm thick cavity is found to be pretty much equal to the radiative one predicted by Planck's theory, and therefore it could be useful to amplify or evacuate heat currents along macroscale gaps.
J. Cacheux, J. Ordonez-Miranda, A. Bancaud, L. Jalabert, D. Alcaide, M. Nomura, Y. T. Matsunaga, **Asymmetry of tensile vs. compressive elasticity and permeability contributes to the regulation of exchanges in collagen gels**, Sci. Adv. 9, eadf9775 (2023).	We developed an instrument to measure the elasticity and permeability of collagen gels under tensile and compressive stress, via the temporal change of pressure in an air cavity. Our results show an asymmetric response in tension and compression, which is expected to be useful for better understanding the blood-associated pulsations within biological tissues. My main contribution to this biophysics work was the development of a theoretical model to fit the experimental data for pressure fluctuations. The publication of this work represents one of the most fruitful collaborations between different research teams hosting CNRS-LIMMS researchers at the University of Tokyo.
S. Tachikawa, J. Ordonez-Miranda, L. Jalabert, Y. Wu, R. Anufriev, Y. Guo, B. Kim, H. Fujita, S. Volz, M. Nomura, **Enhanced far-field thermal radiation through a polaritonic waveguide**, Phys. Rev. Lett. 132, 186904 (2024).	We show that the coating of a microscopic plate of silicon with nanometric layers of silica doubles its far-field thermal radiation. This two-fold enhancement results from the hybridization of surface electromagnetic waves with cavity modes and is well predicted by theory. The obtaining of these results required skills in fabrication, characterization, modeling, and simulations; and represents one of the most fertile collaborations between French and Japanese researchers working at the CNRS laboratory LIMMS and The University of Tokyo.