

Felipe Herrera

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Academic Experience

Universidad de Santiago de Chile, Department of Physics. Associate Researcher [non-tenure-track]	Since 2014
Harvard University, Department of Chemistry and Chemical Biology. Postdoctoral Fellow. Advisor: Alán Aspuru-Guzik	2012 - 2014

Education

University of British Columbia, Ph.D. Chemistry Dissertation: <i>Quantum Control of Binary and Many-Body Interactions in Ultracold Molecular Gases.</i> Advisor: Roman Krems	2007 - 2012
Universidad de Chile, B.Sc. Chemistry Dissertation: <i>Theory of Two-Photon Spectroscopy in Coordination Complexes.</i>	2007

Teaching

- **Graduate Physics :** *Introduction to Atomic, Molecular and Optical Physics.*
- **Undergraduate Physics :** *Physics for Engineering, Physics for Computer Science, Electricity and Magnetism.*
- **Undergraduate Chemistry:** *Quantum Chemistry, Chemistry 101 (Lab TA).*

Honors & Awards

Inserción en la Academia Award PAI, Conicyt	2014
Four Year Fellowship, University of British Columbia	2009
Gladys Estella Laird Fellowship, University of British Columbia	2007
Best Student of Chemistry Award, Universidad de Chile	2007

Grant Funding

Millenium Institute for Research in Optics (MIRO) **2018-2028** [US\$ 16,130,000, co-PI];
Fondecyt Regular **2018-2022** [US\$290,000]; USACH Innovation Grant **2017-2018** [US\$ 8,700];
Conicyt PAI **2014-2016** [US\$ 69,500]; Fondecyt Iniciación **2014-2016** [US\$ 72,500]; CORFO
Technological Contracts for Innovation [US\$ 290,000, co-PI].

Professional Activities

- **Co-Organizer**

"1st Workshop on Molecular Quantum Technologies", Puerto Natales, Chile, Dec. 16-20, 2019.

APS March Meeting DCP Focus Session on "Strong light-matter coupling: Enhanced spectroscopy, modified molecular dynamics and altered chemical reactions", March 5-9, 2018.

"2nd International Workshop on Quantum Coherence and Decoherence", Medellin, August 25-29, 2014.

- **Reviewer**

Physical Review Letters, Journal of Physical Chemistry Letters, New Journal of Physics, Physical Review A, Journal of Physical Chemistry C, Journal of Chemical Physics, European Journal of Physics D, Molecular Physics, Scientific Reports, Physics Letters A, Optics Express, CONICYT [grants].

PUBLICATIONS

- [24] M. Wersäll, B. Munkhbat, D. G. Baranov, **F. Herrera**, J. Cao, T. J. Antosiewicz, T. Shegai, *Correlative dark-field and photoluminescence spectroscopy of individual plasmon-molecule hybrid nanostructures in strong coupling regime*, [submitted]
- [23] F. Hernández and **F. Herrera**, *Multi-level quantum Rabi model for anharmonic vibrational polaritons*, [submitted] arXiv:1906.04374
- [22] I. Chi-Duran, Z. Setifi, F. Setifi, C. Jelsch, B. Morgenstern, A. Vega, **F. Herrera**, D. P. Singh, K. Hegetschweiler and R. Boyaala *Crystal structure and Hirshfeld surface analysis of tris-(2,2'-bi-pyridine)-nickel(II) bis-(1,1,3,3-tetra-cyano-2-eth-oxy-propenide) dihydrate*, Acta Cryst. E75, 867-871, **2019**
- [21] M. J. Carreño, J. Sepúlveda, S. Tecpan, C. Hernández, **F. Herrera**, *An Instrument-Free Demonstration of Quantum Key Distribution for High-School Students*, [submitted] arXiv:1904.10537.
- [20] J. Enríquez, I. Chi-Durán, C. Manquián, **F. Herrera**, D. P. Singh, *Controlled growth of the non-centrosymmetric Zn(3-ptz)₂ and Zn(OH)(3-ptz) metal-organic frameworks*, ACS Omega 4, 7411-7419, **2019**.
- [19] I. Chi-Duran, J. Enríquez, C. Manquian, R. A. Fritz, D. Serafini, **F. Herrera**, D. P. Singh, *Azide-based high-energy metal-organic framework with enhanced thermal stability*, [submitted] <https://doi.org/10.26434/chemrxiv.750190>
- [18] M. Litinskaya and **F. Herrera**, *Vacuum-enhanced optical nonlinearities with organic molecular photoswitches*, Phys. Rev. B 99, 041107(R), **2019**.
- [17] I. Chi-Duran, J. Enríquez, A. Vega, **F. Herrera**, D. P. Singh, *Hexa-aqua-zinc(II) dinitrate bis-[5-(pyridinium-3-yl)tetra-zol-1-ide]*, Acta Cryst. E74, 1231-1234, **2018**.
- [16] I. Chi-Duran, J. Enríquez, C. Manquian, K. Wrighton-Araneda, W. Cañon-Mancisidor, D. Venegas-Yazigi, **F. Herrera**, D. P. Singh, *pH-Controlled Assembly of 3D and 2D Zinc-based Metal-Organic Frameworks with Tetrazole Ligands*, ACS Omega 3, 801-807, **2018**.

- [15] **F. Herrera**, F. C. Spano, *Theory of nanoscale organic cavities: The essential role of vibration-photon dressed states*, ACS Photonics 5, 65, **2018**.
- [14] **F. Herrera**, F. C. Spano, *Absorption and photoluminescence in organic cavity QED*, Phys. Rev. A 95, 053867, **2017**.
- [13] **F. Herrera** and F. C. Spano, *Dark vibronic polaritons and the spectroscopy of organic microcavities*, Phys. Rev. Lett. 118, 223601, **2017**.
- [12] **F. Herrera** and F. C. Spano, *Cavity-controlled chemistry in molecular ensembles*, Phys. Rev. Lett. 116, 238301, **2016**.
- [11] M. Moebius, **F. Herrera**, S. Griesse-Nascimento, O. Reshef, C. Evans, G. G. Guerreschi, Alan Aspuru-Guzik, Eric Mazur, *Efficient photon triplet generation in integrated nanophotonic waveguides*, Opt. Express 24, 9932, **2016**.
- [10] B. Zhu, J. Schachenmayer, M. Xu, **F. Herrera**, J. G. Restrepo, M. J. Holland, A. M. Rey, *Synchronization of interacting quantum dipoles*, New J. Phys. 17, 083063, **2015**.
- [9] **F. Herrera**, B. Peropadre, L. A. Pachon, S. Saikin, A. Aspuru-Guzik, *Quantum nonlinear optics with polar J-aggregates in microcavities*, J. Phys. Chem. Lett. 5, 3708, **2014**.
- [8] **F. Herrera**, Y. Cao, S. Kais, K. B. Whaley, *Infrared-dressed entanglement of cold open-shell polar molecules for universal matchgate quantum computing*, New J. Phys. 16, 075001, **2014**.
- [7] A.A. Kocherzhenko, J. Dawlaty, B. P. Abolins, **F. Herrera**, D. B. Abraham, K. B. Whaley, *Collective effects in linear spectroscopy of dipole-coupled molecular arrays*, Phys. Rev. A 90, 062502, **2014**.
- [6] **F. Herrera**, S. Kais, K. B. Whaley, *Entanglement creation in cold molecular gases using strong laser pulses*, arXiv:1302.6444.
- [5] **F. Herrera**, K. W. Madison, R. V. Krems, M. Berciu, *Investigating polaron transitions with polar molecules*, Phys. Rev. Lett. 110, 223002, **2013**.
- [4] **F. Herrera** and R. V. Krems, *Tunable Holstein model with cold polar molecules*, Phys. Rev. A 84, 051401(R), **2011**.
- [3] J. Perez-Rios, **F. Herrera**, R. V. Krems, *External field control of collective spin excitations in an optical lattice of 2S molecules*, New J. Phys. 12, 103007, **2010**.
- [2] **F. Herrera**, M. Litinskaya, R. V. Krems, *Tunable disorder in a crystal of cold polar molecules*, Phys. Rev. A 82, 033428, **2010**.
- [1] **F. Herrera**, *Magnetic field-induced interference of scattering states in ultracold collisions*, Phys. Rev. A 78, 054702, **2008**.

INVITED PRESENTATIONS

- *Vibrational polaritons in the ultrastrong coupling regime: spectroscopy and chemistry, Workshop on*

Molecular Polaritonics, Madrid, July 2019.

- *Controlling chemistry with quantum optics at the nanoscale, Centro de Óptica Cuántica e Información Cuántica, Universidad Mayor, June 2019.*
- *Controlling chemistry with quantum optics at the nanoscale, JILA seminar, February 2019.*
- *Cavity quantum electrodynamics with organic matter, 2nd Workshop in Optics and Photonics, Universidad de los Andes, December 2018.*
- *Controlling chemistry with quantum optics in nanoscale cavities, 10th International Meeting on Photodynamics and Related Aspects, Cartagena, September 2018.*
- *Holstein-Tavis-Cummings theory of organic polaritons: Spectroscopy and chemistry, 9th International Conference on Spontaneous Coherence in Excitonic Systems, Montreal, July 2018*
- *Holstein-Tavis-Cummings theory of organic polaritons: Spectroscopy and chemistry, Workshop “Quantum Frontiers in Molecular Science”, Telluride, June 2018.*
- *The physics of organic cavities, Fac. de Ciencias Físicas y Matemáticas, Universidad de Chile, Santiago, November 2017.*
- *Controlling chemistry with quantum optics in nanoscale cavities, Fac. de Ciencias, Universidad de Chile, Santiago, July 2017.*
- *Controlling chemistry with quantum optics in nanoscale cavities, Centre for Quantum Technologies, Singapore, Feb. 2017*
- *Controlling chemistry with quantum optics in nanoscale cavities, SMART Centre, Singapore, Feb. 2017*
- *Cavity-controlled chemistry in molecular ensembles, CINV, Valparaiso, July 2016.*
- *Cavity-controlled chemistry in molecular ensembles, CEFOP, Concepción, June 2016.*
- *Cavity-controlled chemistry in molecular ensembles, Photodynamics, Mendoza, May 2016.*
- *Controlling nonlinear optical response and chemical reactions in organic cavities, Pacifichem, Honolulu, December 2015.*
- *Matchgate quantum computing with cold polar molecules, APS March Meeting, San Antonio, March 2015.*
- *Matchgate quantum computing with cold polar molecules, JILA, Boulder, December 2014.*
- *Solid-state nonlinear quantum optics with organic polar molecular aggregates, IWQCD II, Medellín, August 2014.*
- *Controlled entanglement manipulation in cold molecular gases with strong laser pulses, University of British Columbia, Vancouver, May 2013.*
- *Controlled entanglement manipulation in cold molecular gases with strong laser pulses, Kavli Institute for Theoretical Physics, Santa Barbara, March 2013.*
- *Dynamical generation of entanglement in cold molecular gases using strong laser pulses, Institute for Theoretical AMO Physics, Boston, January 2013.*
- *Quantum control of binary and many-body interactions with cold molecules, Quantum Center, University of California Berkeley, May 2012.*
- *Tunable Holstein Hamiltonian with cold polar molecules, Institute for Theoretical AMO Physics, Boston, September 2011.*
- *Tunable Holstein Hamiltonian with cold polar molecules, Institut für Theoretische Physik, Universität Ulm, Ulm, June 2011.*
- *External field control of collective coherence in optical lattices of polar molecules, Institut für Quantenoptik und Quanteninformation, Innsbruck, May 2011.*
- *Quantum interference induced by external fields in ultracold collisions, AMO seminar, University of British Columbia, Vancouver, November 2009.*

CONTRIBUTED PRESENTATIONS

- *Vacuum-enhanced optical nonlinearities with disordered molecular photoswitches* [poster], Workshop on Molecular Polaritonics, Madrid, July **2019**.
- *Controlling chemistry with cavity quantum electrodynamics*, APS March Meeting, Los Angeles, March **2018**.
- *Absorption and photoluminescence in organic cavity QED* [poster], APS March Meeting, Los Angeles, March **2018**.
- *Cavity-controlled chemistry in molecular ensembles*, SCOM, San Sebastian, October **2016**.
- *Cavity-controlled chemistry in molecular ensembles*, ICSC8, Edinburgh, April **2016**.
- *Noise-resilient quantum metrology for single-molecule spectroscopy*, APS March Meeting, San Antonio, March **2015**.
- *Low-light-level nonlinear optics with organic microcavities* [poster], Gordon Research Conference in Quantum Science, Easton, July **2014**.
- *Alignment-mediated entanglement of cold polar molecules*, 44th Annual Meeting of the APS Division of AMO Physics, Quebec city, June **2013**.
- *Investigating polaron transitions with cold polar molecules* [poster], New Science with Ultracold Molecules Conference, Santa Barbara, March **2013**.
- *Tunable Holstein model with cold polar molecules*, 43rd Annual Meeting of the APS Division of AMO Physics, Orange County, June **2012**.
- *Entanglement of cold molecules with strong optical pulses* [poster], 43rd Annual Meeting of the APS Division of AMO Physics, Orange County, June **2012**.
- *Controlled dissipation in a molecular crystal of cold polar molecules*, 30th CNLS Annual Conference on Complexity and Disorder at Ultra-low Temperatures", Santa Fe, June **2010**.
- *Resonant scattering of rotational excitons in optical lattices with polar molecules* [poster], Coherence in Ultracold Molecular Physics Workshop, Vancouver, May **2010**.
- *Controlling collective rotational excitations of polar molecules in optical lattices*, 41st Annual Meeting of the APS Division of AMO Physics, Houston, May **2010**.
- *Interference induced by static magnetic fields in ultracold collisions*, 6th Congress of the International Society of Theoretical Chemical Physics, Vancouver, July **2008**.