

# Felipe Herrera

Department of Physics, Universidad de Santiago de Chile USACH.

Av. Ecuador 3493, Estación Central, Santiago - Phone: (56 2) 27181203 - Email: felipe.herrera.u@usach.cl

---

## 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: *Quantum Control of Binary and Many-Body Interactions in Ultracold Molecular Gases.*  
Advisor: Roman Krems

2007 - 2012

**Universidad de Chile, B.Sc. Chemistry**  
Dissertation: *Theory of Two-Photon Spectroscopy in Coordination Complexes.*

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, CONICYT [grants].

## PUBLICATIONS

- [21] M. J. Carreño, J. Sepúlveda, S. Tecpan, C. Hernández, **F. Herrera**, *An Instrument-Free Demonstration of Quantum Key Distribution for High-School Students*, [preprint] 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)<sub>2</sub> 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*, [preprint] <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  $^2\text{S}$  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

- *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*, Pacificchem, 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

- *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**.