

Francisco Salces-Cárcoba
Barish-Weiss Postdoctoral Scholar

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EDUCATION

PhD, Physics

University of Maryland College Park, College Park, MD, May 2020

Title of dissertation: *Microscopy of elongated superfluids*

BSc, Physics

Universidad Autónoma de San Luis Potosí, San Luis Potosí, S.L.P., Mexico, 2013

**SKILLS AND
EXPERTISE**

General: Experimental physics; gravitational wave detection, atomic, molecular, optical physics, quantum mechanics.

Hardware: Optics; passive and active optical design from 400 to 2300 nm, laser spectroscopy, adaptive optics, holography, coherent microscopy, optical cavities, and laser systems. Vacuum; high and ultra-high vacuum down to 10^{-12} mbar. Electronics; basic DC and AC applications into the radiofrequency and microwave domain at 10 GHz. Mechanics; basic machining and assembly of components and structures.

Software: Numerical analysis & hardware interfaces; Python, Matlab, ImageJ, Labview, VHDL, bash, hpc. CAD; Solidworks, Zeemax, Eagle. Other; L^AT_EX.

Personal repositories; <https://github.com/pacosalces>

**RESEARCH
TASKS**

Barish-Weiss Postdoctoral Fellow

2020-present

Mariner: 40m prototype of a cryogenic gravitational wave detector

California Institute of Technology, Pasadena, CA

- 2.1 μm lasers for next-generation cryogenic gravitational wave interferometry.
- 1.4 μm lasers for next-generation cryogenic gravitational wave detector arm-length stabilization.
- Strain calibration for optimal gravitational wave detector parameter estimation.

Graduate research assistant

2017-2020

Holographic microscopy of ultracold ^{87}Rb

Joint Quantum Institute (University of Maryland and NIST), Gaithersburg, MD

- Off-axis digital holographic microscope for ^{87}Rb gases.
- Digital aberrations correction using holography and atom shot noise.

Graduate research assistant

2016-2018

New apparatus for quantum degenerate Bose gases

Joint Quantum Institute (University of Maryland and NIST), Gaithersburg, MD

- Design and assembly of ultra-high vacuum manifolds.
- Design of magnetic quadrupole based cold atom transport.
- Design mounting structure and general layout for the apparatus.

Graduate research assistant 2015-2017

Thermodynamics of one-dimensional Bose gases

Joint Quantum Institute (University of Maryland and NIST), Gaithersburg, MD

- Design, build and characterize high-aspect ratio, cross optical dipole trap.
- Design, build and characterize compound microscope objective (NA = 0.31).
- Calibrate optimal absorption imaging of dilute $\sim 1 \mu\text{m}^{-1}$ linear gases.
- Benchmark *in-situ* density distributions with numerically exact model.

Graduate research assistant 2014-2015

Digital control loop for magnetic field stabilization

Joint Quantum Institute (University of Maryland and NIST), College Park, MD

- Design and simulate 20-bit, FPGA-based feedback system for electromagnets.

Undergraduate research assistant 2011-2013

Passive thermal stabilization of optical cavities

Laboratorio de Atomos Frios, Instituto de Fisica UASLP, S.L.P, Mexico

- Design and assembly of composite material spacers for confocal cavity.
- Measure thermally driven frequency drift of the linear cavity.
- Model thermal transient with 4th-order Runge–Kutta finite-element code.

Undergraduate research intern Summer 2012

Soft X-ray calorimetry from electron recapture

Oak Ridge National Lab, Oak Ridge, TN

- Operate keV molecular ion beam accelerator.
- Operate high resolution X-ray cryogenic (0.1K) calorimeter.

Undergraduate research assistant 2009-2011

Two-photon correlation functions $g^{(2)}(\tau)$

Laboratorio de Atomos Frios, Instituto de Fisica UASLP, S.L.P, Mexico

- Automate measurements using two single photo detectors and oscilloscope.

**PEER-
REVIEWED
PUBLICATIONS**

- [1] A. R. Perry, S. Sugawa, **F. Salces-Carcoba**, Y. Yue, and I. B. Spielman. “Multiple-camera defocus imaging of ultracold atomic gases”. In: *Opt. Express* 29.11 (2021), pp. 17029–17041. URL: <http://www.opticsexpress.org/abstract.cfm?URI=oe-29-11-17029>.
- [2] Andika Putra, **F. Salces-Carcoba**, Yuchen Yue, Seiji Sugawa, and I. B. Spielman. “Spatial Coherence of Spin-Orbit-Coupled Bose Gases”. In: *Phys. Rev. Lett.* 124 (5 2020), p. 053605. URL: <https://link.aps.org/doi/10.1103/PhysRevLett.124.053605>.
- [4] **F. Salces-Carcoba**, C. J. Billington, A. Putra, Y. Yue, S. Sugawa, and I. B. Spielman. “Equations of state from individual one-dimensional Bose gases”. In: *New Journal of Physics* 20 (2018), p. 113032. URL: <https://doi.org/10.1088%2F1367-2630%2Faef9b>.
- [5] S. Sugawa, **F. Salces-Carcoba**, A. R. Perry, Y. Yue, and I. B. Spielman. “Second Chern number of a quantum-simulated non-Abelian Yang monopole”. In: *Science* 360.6396 (2018), pp. 1429–1434. URL: <https://science.sciencemag.org/content/360/6396/1429>.

- [6] K. Morgan, V. Andrianarijaona, I. N. Draganic, X. Defay, M. Fogle, A. Galindo-Uribarri, C. I. Guillen, C. C. Havener, M. Hokin, D. McCammon, D. J. Nader, S. L. Romano, **F. Salces-Carcoba**, P. Sauter, D. Seely, P. C. Stancil, C. R. Vane, A. K. Vasantachart, and D. Wulf. “Charge exchange x-ray emission: Astrophysical observations and potential diagnostics”. In: *AIP Conference Proceedings* 1525.1 (**2013**), pp. 49–54. URL: <https://aip.scitation.org/doi/abs/10.1063/1.4802288>.

**OTHER
PUBLICATIONS**

- [3] S. Sugawa, **F. Salces-Carcoba**, Y. Yue, A. Putra, and I. B. Spielman. *Observation and characterization of a non-Abelian gauge field’s Wilczek-Zee phase by the Wilson loop*. **2019**. arXiv: [1910.13991](https://arxiv.org/abs/1910.13991) [[physics.atom-ph](#)].

AFFILIATIONS

- American Physical Society (2016 – present)
- Optical Society of America (2020 – present)