

Sebastián Francisco Vázquez-Carson

Education

2017–2022 **Doctor of Philosophy (Defending May)**, *Atomic, Molecular, and Optical Physics*, Columbia University, New York

2013–2017 **Bachelor of Arts and Science Magna Cum Laude**, *Physics*, University of Colorado, Boulder

Technical Experience

Software and Simulations:

- Python
- C++
- Mathematica
- Solidworks
- DS2V Direct Monte Carlo Hydrodynamic Simulation Package
- Labview
- Matlab
- Light Tools
- Autocad

Photonics Hardware:

- External Cavity Diode Lasers(Littrow and Littman-Metcalf)
- Injection Locking Amplifiers
- Doppler Free Saturation Abs Spectroscopy Locking
- Imaging System Optics
- Silicone Photon Multipliers
- EMCCD Single Photon Cameras
- Tapered Amplifiers
- Raman Fiber Amplifiers
- Fizeau Interferometer Locking
- In-Vacuum Optics
- Analogue Photomultipliers

RF Electronics:

- Spectrum Analysers
- RF Amplifiers
- Acousto-Optical Modulators
- Electro-Optical Modulators
- DDS RF Signal Generators
- RF Voltage Controlled Oscillators
- Acousto-Optical Deflectors
- Scanning Fabry-Perot Cavities

Cryogenic Hardware:

538 W 120th St Pupin Hall Room 704 – New York, NY, 10027

☎ (303) 325 4750 • ✉ sfv2108@columbia.edu

🌐 www.sebastian-francisco.com

- Design and Maintenance of Custom 4K Cryogenic Cell
- Maintenance of a Pulse Tube Refrigerator
- Cryogenic Charcoal Chemical Absorbers Design and Fabrication
- Cryogenic Chamber Vacuum System Design

Vacuum Hardware:

- Custom designed UHV chamber
- Magneto-Optical Trap Chamber Design
- Cryogenic Vacuum Chambers
- In-Vacuum Optics Design and Fabrication

Fabrication:

- Automated Quality Control
- Laser Cutters
- CNC Lathes
- Electro-plating
- 3D Printer
- Water Jet
- CNC Mills
- Bandsaws

Languages

Native Proficiency in:

- English (United States Citizen)
- Spanish

Research Experience

- 2018-2022 Physics PhD researcher with the Zelevinsky group at Columbia University. While I was the lead grad student at the molecular cooling experiment at Columbia I developed full laser system used to laser cool a cryogenic beam of first barium hydride and subsequently calcium hydride molecules. This required building ECDL lasers (Littrow and Litman-Metcalf), amplifiers (TAs, ILAs, fiber amplifiers), and radio frequency modulation (EOM's, AOM's, RF amplifiers, VCO's, and DDS's). I also wrote VI's the experiment's Labview control; and designed and fabricated custom components for the vacuum system and the cryogenic helium system.
- Summer 2017 Graduate researcher with the Will group at Columbia University. While at the Will group I built PID lock boxes for the laser system, helped to build a Doppler free absorption spectroscopy reference of cesium. Finally, I calculate confinement potentials for a 2D MOT to improve the efficiency of MOT loading.
- April, 2016 Attended Fermi National Accelerator Laboratory in April 2016 to test the prototype hadronic calorimeter I was involved in developing for the sPHENIX experiment. While at Fermilab I assembled my detector components and ran the collider DAQ (Data Acquisition). This successful test served as a final verification of the detector design and performance before full assembly at the Relativistic Heavy Ion Collider in Brookhaven National Lab.
- 2015-2017 Undergraduate researcher with the Nagle group at the University of Colorado at Boulder. While at the Nagle high energy nuclear physics lab at CU Boulder, I developed an automated quality control stand to test gain uniformity of scintillating panels before those panels could be installed in the sPHENIX experiment at the Relativistic Heavy Ion Collider at Brookhaven National Lab. Finally, I developed an algorithm in C++ to analyze data from nuclear collisions at the collider that would calculate the number of nuclear collisions per bunch crossing.

Professional Experience

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Nov, 2021 Chief Technical Officer, Parana Mining Company. I started a bitcoin mining company in Paraguay that aims to provide hosting services for commercial clients seeking to invest in Bitcoin mining. Parana Mining Company takes advantage of the fully renewable hydroelectric power from the Itaipu Dam on the border between Brazil and Paraguay to provide clients with the most competitive electricity prices and state-of-the-art facilities suitable for Bitcoin mining and other proof of work protocols.

Publications

- NJP S. Vazquez-Carson et al. *Direct laser cooling of calcium monohydride molecules*, Submitted to NJP, 2022. arXiv:2203.04841
- NJP R. McNally, I. Kozyrev, S. Vazquez-Carson et. al. *Optical cycling, radiative deflection and laser cooling of barium monohydride (BaH)*, New Journal of Physics, Vol 22, August, 2020. arXiv:2004.09570
- Nature Physics C. Aidala et al. *Creating Small Circular, Elliptical, and Triangular Droplets of Quark-Gluon-Plasma*, Nature Physics, 2019, Vol 15. arXiv:1805.02973
- PRL A. Adare et al. *Pseudorapidity Dependence of Particle Production and Elliptic Flow in Asymmetric Nuclear Collisions of p+Al, p+Au, d+Au and $^3\text{He} + \text{Au}$ at $\sqrt{s_{NN}} = 200$ GeV*, Physical Review Letters, 2018, Vol 121. arXiv:1807.11928
- PRL C. Aidala et al. *Nuclear Dependence of the Transverse-Single-Spin Asymmetry for Forward Neutron Production in Polarized p+A Collisions at $\sqrt{s_{NN}} = 200$ GeV*, Physical Review Letters, 2018, Vol 120, Issue 2, January 2018. arXiv:1703.10941v2
- PRL C. Aidala et al. *Measurements of Multiparticle Correlations in d+Au Collisions at 200, 62.4, 39, and 19.6 GeV and p+Au Collisions at 200 GeV and Implications for Collective Behavior*, Physical Review Letters, 2018, Vol 120, Issue 6, February 2018. arXiv:1707.06108v2
- PRL A. Adare et al. *Pseudorapidity Dependence of Particle Production and Elliptic Flow in Asymmetric Nuclear Collisions of p+Al, p+Au, d+Au and $^3\text{He} + \text{Au}$ at $\sqrt{s_{NN}} = 200$ GeV*, Physical Review Letters, 2018, Vol 121. arXiv:1807.11928
- PRL C. Aidala et al. *Nuclear Dependence of the Transverse-Single-Spin Asymmetry for Forward Neutron Production in Polarized p+A Collisions at $\sqrt{s_{NN}} = 200$ GeV*, Physical Review Letters, 2018, Vol 120, Issue 2, January 2018. arXiv:1703.10941v2
- PRL C. Aidala et al. *Measurements of Multiparticle Correlations in d+Au Collisions at 200, 62.4, 39, and 19.6 GeV and p+Au Collisions at 200 GeV and Implications for Collective Behavior*, Physical Review Letters, 2018, Vol 120, Issue 6, February 2018. arXiv:1707.06108v2
- IEEE C. Aidala et al. *Design and Beam Test Results for the sPHENIX Electromagnetic and Hadronic Calorimeter Prototypes*, IEEE Transactions on Nuclear Science, April 2017. arXiv:1704.01461v1
- Phys. Rev. C C. Aidala et al. *Measurements of second-harmonic Fourier coefficients from azimuthal anisotropies in p+p, p+Au, d+Au, and $^3\text{He} + \text{Au}$ collisions at $\sqrt{s_{NN}} = 200$ GeV*, Submitted to Physics Review C, 2022, arXiv:2203.09894

More publications available on my website www.sebastian-francisco.com