

Sergio H. Cantu

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Education

Massachusetts Institute of Technology

Ph.D. Department of Physics.
Thesis: Quantum Light Engineering via Rydberg Polaritons.

Cambridge, MA
Sept 2014-Present.

Massachusetts Institute of Technology

Bridge to Ph.D. Program, Department of Physics. (Non-Degree)
Project: Raman Sideband Cooling of Rubidium atoms.

Cambridge, MA
Aug 2014

The University of Texas at Brownsville

B.S. in Physics - Department of Physics & Astronomy.
B.S. in Mathematics - Department of Mathematics.
Thesis: Design and Characterization of Optical Resonators for Advanced LIGO.

Brownsville, TX
May 2012.

Awards

Sergio Vazquez Prize (2018), El Mundo Boston Latino 30 under 30 (2018), NSF Graduate Research Fellow (2014-2019), Center for Gravitational-Wave Astronomy (CGWA)-NASA Scholarship (2007-2012), Arecibo Remote Command Center Scholarship(2008), Sydney V. Neely Mathematics Scholarship (2008).

Research

Center for Ultracold Atoms

Advisors: Vladan Vuletić & Mikhail Lukin
Realizing robust quantum phenomena in strongly interacting systems is one of the central challenges in modern physical science. Although photonphoton interactions are typically negligible in conventional optical media, hybridizing light with ensembles of strongly interacting particles has emerged as a promising route toward achieving few photon-nonlinearities. Our approach is to interface light with highly excited atomic Rydberg states by means of electromagnetically induced transparency (EIT), an approach which allows to induce strong long-range interactions between freely propagating photons in the form of polaritons.

MIT-Harvard
2012-2014

Experience

Bridge to PhD Program

Advisor: Vladan Vuletić
Studied and implemented optical lattices for application in laser trapping and cooling of Rb atoms known as Raman Sideband Cooling. Characterized and optimized optical systems of a dipole trap of Rb atoms to improve the measurement of quantum nonlinearities at the single photon level.

MIT
2012-2014

Center for Gravitational-Wave Astronomy

Advisor: Malik Rakhmanov

UTB
2008-2012

Conditioned a classroom into a optics lab, setup a computer cluster for theoretical experiments. Simulated the resonance stability of triangular ring resonators using novel ray tracing and Gaussian propagation techniques. Studied and modeled photonic crystal structures and related phenomena (i.e. Negative Index of refraction, Perfect mirrors, and silicon ring resonators).

Space Propulsion Laboratory

MIT

Advisor: Paulo C. Lozano

Summer 2011

Development of an electrochemistry-free ionic liquid ion source (ILIS) for applications in space propulsion devices. The project approach entailed the introduction of silica colloid-based materials, specifically silica aerogel and a silica foam ceramic into a bipolar ILIS and the characterization of the emissions of the modified structures for future optimization.

Laser Interferometer Gravitational-Wave Observatory

MIT

Advisor: Nergis Mavalvala

Summer 2011

Development of an electrochemistry-free ionic liquid ion source (ILIS) for applications in space propulsion devices. The project approach entailed the introduction of silica colloid-based materials, specifically silica aerogel and a silica foam ceramic into a bipolar ILIS and the characterization of the emissions of the modified structures for future optimization.

Laser Interferometer Gravitational-Wave Observatory

Hanford, WA

Advisor: Richard Savage

2008-2009

Characterization and fabrication of triangular Fabry-Perot resonators. Design of optical mechanical components for optical setup. Characterization of 500 mW 1064nm Nd:YAG laser. Studied and Implemented the Pound-Drever-Hall technique for phase stabilization in a laser system.

Arecibo Remote Command Center

UTB

Advisor: Fredrick A. Jenet

2008-2009

Obtained and characterized data from the Arecibo Radio Telescope searching for potential millisecond pulsars. Worked in the original team to model how gravitational-wave interferometers, such as the Laser Interferometer Gravitational-Wave Observatory (LIGO), could be used to trigger the detection of Short Gamma Ray Bursts to localize them in space.

Publications

Qi-Yu Liang, Aditya V. Venkatramani, **Sergio H. Cantu**, Travis L. Nicholson, Michael J. Gullans, Alexey V. Gorshkov, Jeff D. Thompson, Cheng Chin, Mikhail D. Lukin & Vladan Vuletić (2018) *Observation of three-photon bound states in a quantum nonlinear medium*. Science 359, 783-786

Jeff D. Thompson, Travis L. Nicholson, Qi-Yu Liang, **Sergio H. Cantu**, Aditya V. Venkatramani, Soonwon Choi, Ilya A. Fedorov, Daniel Viscor, Thomas Pohl, Mikhail D. Lukin & Vladan Vuletić (2017) *Symmetry-protected collisions between strongly interacting photons*. Nature 542, 206–209

Soumya D Mohanty & **Sergio Cantu** (2011) *Teaching introductory undergraduate*

physics using commercial video games. Phys. Educ. 46 570.

Teaching Experience	<p>MIT, Dept. of Physics Spring 2017</p> <p>Atomic and Optical Physics: Quantum States and Dynamics of Photons. Teaching Assistant</p> <p>Helped write problem sets and exams. Supervised other teaching assistants and graders. Addressed individual students' questions and needs both in person and in the online community.</p>
	<p>UTB, Dept. of Physics Winter 2010</p> <p>Elementary Physics with Video games. Teaching Assistant</p> <p>Developed an experimental class for non-science majors centered around videogames. Students characterized the physics engine of a videogame. Topics covered included: simple harmonic motion, projectile motion, Newton's laws, parametrization in physics, Conservation laws.</p>
Selected Presentations	<p><i>Repulsive Photon-Photon Interactions mediated by Rydberg atoms.</i> Quantum Fluids of Light and Matter 2018. Ecole de Physique des Houches, 2018.</p>
	<p><i>Three-photon interactions and spin exchange in a quantum nonlinear medium.</i> 47th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics, May 23–27, 2016. Providence, Rhode Island.</p>
	<p><i>Low-Loss Optical Resonator for Laser Interferometer Gravitational-Wave Observatory.</i> The National Society of Hispanic Physicists and The National Society of Black Physicists (NSBP-NSHP) joint annual meeting, February 2009. Undergraduate Poster Award, sponsored by OSA/SPIE, for Best Poster in Optics and Photonics.</p>
	<p><i>Laser Stabilization Techniques for Gravitational Wave Detectors.</i> The American Physical Society Texas Section Meeting, 2010.</p>
	<p><i>Interferometric Displacement Sensor for Advanced LIGO.</i> The Society for the Advancement of Chicanos and Native Americans in the Sciences (SACNAS) 2010 annual meeting.</p>
	<p><i>Dynamic Response and Locking of Optical Resonators for LIGO.</i> APS Texas Section meeting, October 2009.</p>
	<p><i>Characterization of Optical Resonators for LIGO.</i> Annual Review Meeting for the Consortium for Nanomaterials for Aerospace Commerce and Technology (CON-TACT), UTPA, Edinburg, TX, September 2009.</p>
Activities	<p><i>Development of an electrochemistry-free Ionic Liquid Ion Source.</i> NSBP-NSHP Annual Joint Conference, September 2011, Austin TX.</p>
	<p>Elected President <i>Mexican Student Association</i>, MITMEX. Elected Treasurer <i>Academy of Courageous Minority Engineers</i>. Instructor Clubes de Ciencia Mexico, 2015.</p>

References

Vladan Vuletić
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Harvard University
Department of Physics
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