

Robert Tyler Sutherland

Position	Assistant Professor
Contact	Phone: (256) 684-3640 E-mail: robert.sutherland@utsa.edu
	Department of Electrical and Computer Engineering The University of Texas at San Antonio San Antonio, Texas 78249-0669
Education	Purdue University , West Lafayette, Indiana Ph.D. in Physics, 2017 Advisor: Francis Robicheaux Thesis: Coherent Radiation in Atomic Systems
	Auburn University , Auburn, Alabama B.S. in Physics, 2014 <i>Summa cum Laude</i>
Publications	<ul style="list-style-type: none">• Sutherland R. T., Foss-Feig M. (2023) Laser-free trapped ion entangling gates with AESE: Adiabatic Elimination of Spin-motion Entanglement. arXiv:2308.05865 (under review at New Journal of Physics).• Sutherland R. T., Allcock D. T. C., Srinivas R. (2023) Individual addressing of trapped ion qubits with geometric phase gates. Physical Review A 107, 032604.• Băzăvan O., Saner S., Minder M., Hughes A. C., Sutherland R. T., Lucas D. M., Srinivas R., Ballance C. J. (2023) Synthesizing a $\hat{\sigma}_z$ spin-dependent force for optical, metastable, and ground-state trapped-ion qubits. Physical Review A 107, 022617.• Sutherland R. T., Yu Q., Beck K. M., Häffner H. (2022) One- and two-qubit gate infidelities due to motional errors in trapped ions and electrons. Physical Review A 105, 022437.• Yu Q., Alonso A. M., Caminiti C., Beck K. M., Sutherland R. T., Leibfried D., Rodriguez K. J., Madhav D., Hemmerling B., Häffner H. (2022) Feasibility study of quantum computing using trapped electrons. Physical Review A 105, 022420.• G. Ferioli, Glicenstein A., Robicheaux F., Sutherland R. T., Browaeys A., Ferrier-Barbut I. (2021) Laser driven superradiant ensembles of two-level atoms near Dicke's regime. Physical Review Letters 127, 243602.• Sutherland R. T., Srinivas R. (2021) Universal hybrid quantum computing in trapped ions. Physical Review A 104, 032609.• Sutherland R. T., Burd S. C., Slichter D. H., Libby S. B., Leibfried D. (2021) Motional squeezing for trapped ion transport and separation. Physical Review Letters 127, 083201.• Srinivas R., Burd S. C., Knaack H. M., Sutherland R. T., Kwiatkowski, A., Glancy S., Knill E., Wineland D. J., Wilson A. C., Allcock D. T. C., Slichter D. H. (2021) High-fidelity laser-free universal control of trapped ion qubits. Nature 597, 209-213.• Sutherland R. T., Srinivas R., Burd S. C., Liebfried D., Wilson A. C., H.M. Knaack, Wineland D. J., Allcock D. T. C., Slichter D. H., Libby S. B. (2019) Laser-free trapped-ion entangling gates with simultaneous insensitivity to qubit and motional decoherence. Physical Review A 101, 042334.• Robicheaux F., Sutherland R. T. (2020) Photon scattering from a cold, Gaussian atom cloud. Physical Review A 101, 013805.• Sutherland R. T. (2019) Analog quantum simulation of superradiance and subradiance in trapped-ions. Physical Review A 100, 061405. <i>Rapid Communication</i>

- Srinivas R., Burd S. C., **Sutherland R. T.**, Wilson A. C., Wineland D. J., Liebfried D., Allcock D. T. C., Slichter D. H. (2019). Trapped-ion spin-motion coupling with microwaves and a near-motional oscillating magnetic field gradient. *Physical Review Letters* **122**, 163201.
Editors Suggestion
- **Sutherland R. T.**, Srinivas R., Burd S. C., Liebfried D., Wilson A. C., Wineland D. J., Allcock D. T. C., Slichter D. H., Libby S. B. (2019). Versatile laser-free trapped-ion entangling gates. *New Journal of Physics* **21**, 033033.
- **Sutherland R. T.**, Robicheaux F. (2017). Degenerate Zeeman ground states in the single-excitation regime. *Physical Review A* **96**, 053840.
- **Sutherland R. T.**, Robicheaux F. (2017). Superradiance in inverted multilevel atomic clouds. *Physical Review A* **95**, 033839.
- **Sutherland R. T.**, Robicheaux F. (2016). Collective dipole-dipole interactions in an atomic array. *Physical Review A* **94**, 013847.
- **Sutherland R. T.**, Robicheaux F. (2016). Coherent forward broadening in cold atom clouds. *Physical Review A* **93**, 023407.

Patents

- **Sutherland R. T.** (2019). Intrinsic dynamically decoupled gates. U.S. Patent Application 16/783875.
- **Sutherland R. T.** (2023). Transport assisted geometric phase gate using a static magnetic field gradient. U.S. Patent Application 18/449967.
- **Sutherland R. T.**, Foss-Feig M. (2023). Rapid adiabatic passage to magnetic field sensitive states for adiabatic elimination of spin-motion coupling in waveless geometric phase gates. U.S. Patent Application 63/487076.
- **Sutherland R. T.**, Burton W.C., Gilbreth C.N., Madjarov I., Fabrikant M., Lauria P.L. (2023). Phonon adiabatic rapid passage:phARP. U.S. Patent Application 63/513379 and 63/589433.
- **Sutherland R. T.** (2023). Eliminating linear dependence of 0G clock state frequency on Bz using a microwave dressing field. U.S. Patent Application 63/581017.
- **Sutherland R. T.**, Erickson S.D. (2023). Temporarily changing the quantization field of a trapped ion chain using an integrated circuit. U.S. Patent Application 63/525300.
- **Sutherland R. T.** (2023). Laser-free one qubit gate using a microwave dressing field. U.S. Patent Application 63/581019.

Google Scholar:

https://scholar.google.com/citations?user=leoyPoAAAAJ&hl=en&user=leoyP_oAAAAJ

Awarded Grants

Quantum computing with trapped electrons (2021) - joint proposal with UC Berkeley Ion Trap Group, Berkeley, CA.

- **Agency:** Lawrence Livermore National Laboratory LDRD
- **Result:** \$125,000 - 1 year

All-electronic ion qubits (2019) - joint proposal with NIST Ion Storage Group, Boulder, CO.

- **Agency:** U.S. Army Research Office
- **Result:** \$1,000,000/year - 3 years

Research Experience

Atomic Molecular and Optical Theory Group Leader, Quantinuum, 2022 - present

Assistant Professor, Electrical and Computer Engineering/Physics and Astronomy Departments, The University of Texas at San Antonio, 2020 - present

Research Scientist, Physics Division, Theory and Modeling Group, Lawrence Livermore National Lab, 2020

Postdoctoral Researcher, Physics Division, Theory and Modeling Group, Lawrence Livermore National Lab, 2017 - 2020

Graduate Research Assistant, Robicheaux Group, Purdue University Physics and Astronomy, 2014 - 2017

Undergraduate Research Assistant, Loch Group, Auburn University College of Sciences and Mathematics, 2012-2014

REU Intern, Smith Group, Harvard-Smithsonian Center for Astrophysics , Summer 2013

Presentations

- November, 2023. “Cooling trapped ions with phonon rapid adiabatic passage: phRAP”. Invited seminar, Stony Brook, NY.
- June, 2023. “Individual addressing of trapped ion qubits with geometric phase gates”. Oral presentation at DAMOP, Spokane, WA.
- January, 2022. “Trapped ion quantum computing with microwaves”. Invited talk for ICONIQ workshop at Imperial College, London, UK.
- October, 2021. “Panel: Convergence of machine learning and quantum computing”. Moderator for AI and quantum computing symposium, Columbia, MD.
- October, 2021. “Panel: Quantum computing Today”. Panelist for AI and quantum computing symposium, Columbia, MD.
- June, 2021. “Motional squeezing for trapped ion transport and separation”. Virtual oral presentation at DAMOP.
- June, 2021. “Non-linear trapped-ion spin-motion coupling with orthogonal geometric phase gates”. Virtual poster presentation at DAMOP.
- September, 2020. “Improving how we use quantum computing platforms”. Invited virtual seminar at Max Planck Institute for the Physics of Complex Systems, Dresden, Germany.
- June, 2020. “Analog quantum simulation of superradiance and subradiance in trapped ions”. Virtual Oral presentation at DAMOP, Portland, OR.
- June, 2020. “Laser-free trapped-ion entangling gates with simultaneous insensitivity to qubit and motional decoherence”. Poster presentation at DAMOP, Portland, OR.
- February, 2020. “Trapped-ion entangling gates that are insensitive to qubit and motional decoherence”. Poster presentation at Southwest Quantum Information and Technology Workshop, Eugene, OR. (Poster award)
- July, 2019. “Trapped-ion entangling gates that are insensitive to qubit and motional decoherence”. Poster presentation at annual LPS conference, Annapolis, MD.
- July, 2019. “Trapped-ion entangling gates that are insensitive to qubit and motional decoherence”. Poster presentation at NACTI conference, College Park, MD.
- May, 2019. “Trapped-ion entangling gates that are insensitive to qubit and motional decoherence”. Poster presentation at DAMOP, Milwaukee, WI.
- May, 2019. “Versatile laser-free trapped-ion entangling gates”. Oral presentation at DAMOP, Milwaukee, WI.
- September, 2018. “Keeping Livermore’s ion quantum computing”. Oral presentation at LLNL Research Slam, Livermore, CA.
- June, 2018. “Microwave-driven entangling gates in the bichromatic interaction picture”. Poster presentation at annual LPS conference, Denver, CO.
- June 7, 2017. “Superradiance in Inverted Multi-level Atomic Clouds”. Oral presentation at DAMOP, Sacramento, CA.
- September 2016. “Collective Photon Scattering in Atomic Ensembles”. Poster presentation at Physique Mésoscopique des Ondes pour Imagerie en Milieux Complexes, Corsica, France.
- October 2016. “Collective Photon Scattering in Atomic Arrays and Clouds”. Poster presentation at MCAW, Chicago IL.
- June 2016. “Collective Photon Scattering in Atomic Arrays and Clouds”. Poster presentation at DAMOP, Providence RI.
- November 2015. “Superradiance in the Single Photon Regime”. Poster presentation at MCAW, Madison WI.
- October 2015. “Superradiance in the Single Photon Regime”. Poster presentation at PQC

Kickoff Workshop, West Lafayette IN.

Teaching Experience

Past Students

- Master's advisor, Gabriel Maldonado (UTSA 2020)

Courses Taught

- Spring 2022, Introduction to machine learning (UTSA, EE-3533)
- Fall 2021, Quantum Mechanics II (UTSA, PHY-4423)
- Spring 2021, Electromagnetic engineering (UTSA, EE-3213)

TA Experience

- Summer 2014, Laboratory Teaching Assistant (Purdue University, PHYS 172).
- Fall 2013, Laboratory Teaching Assistant (Auburn University, PHYS 1610)
- Spring 2013, Laboratory Teaching Assistant (Auburn University, PHYS 1600)
- Fall 2012, Laboratory Teaching Assistant (Auburn University, PHYS 1500)

Awards

Auburn University Physics Senior of the Year

Auburn University Physics Junior of the Year

Phi Kappa Phi Honor Society

Auburn University Dean's List (all semesters)

Barry M. Goldwater Scholarship (Honorable Mention)

Auburn University University Founder's Scholar (Full Tuition)

Auburn University College of Sciences and Mathematics Research Fellowship

Leadership Experience

Quantinuum AMO theory group leader 2022-present

UTSA Electrical and Computer Engineering, Faculty Evaluation Committee Member

UTSA Physics and Astronomy, Quantum Group Leader

Graduate Student Association Representative 2015

Auburn University Society of Physics Students, President (2013-2014)

Loachapoka Elementary Outreach Program, Founder/Organizer (2013-2014)

Auburn University Undergraduate Research Board (2013-2014)

Programming Languages

C/C++, Fortran 95/2003, Python, Mathematica, Tensorflow