Alec Gaddie

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PhD in Experimental Atomic Physics

Finishing graduate school as an experimentalist in AMO physics. Familiar with designing and constructing optical systems for experimental use from the ground up, as well as designing and testing in-vacuum microwave resonators. Currently writing thesis and finalizing experimental data.

Work Experience

Graduate Research Assistant April 2020 - Expected spring 2027

Worked in the Biedermann research group at the University of Oklahoma starting near the beginning of its operation in spring of 2020. Extensive experience designing and constructing the optical and electronic systems for operating the Cs atom array experiment in the lab.

Graduate Teaching Assistant August 2019 - December 2020

Primarily taught and graded as a lab assistant for undergraduate electronics.
- PHYS 2303, Electronics

Projects

Cesium Array Experiment

An array of neutral Cs atoms that provides a platform for quantum simulations. With a powerful UV laser, atoms can be directly excited to Rydberg states quickly. Entangling interactions using Rydberg and ground state atoms allow for large entangled spin states, permitting novel experiments for high fidelity quantum control.

In-Vacuum Microwave Resonator

A microwave resonator designed for use inside a vacuum system, encasing an array of Cs qubits. The resonator is designed to have a resonant frequency matching the hyperfine splitting of the ground state of Cs, with the mode sustaining a magnetic field maximum at the atom array. This permits a homogeneous, fast Rabi frequency across the entire array, enabling global microwave control of the atoms.

Education

2019 - present Ph.D. (Physics) at **University of Oklahoma**
2019 - 2022 M.S. (Physics) at **University of Oklahoma**
2015 - 2019 B.S. (Engineering Physics) at **University of Oklahoma**

Publications

Gaddie, A., A Laha, H-V. Do, et al. (June 2023). *Many-body Physics with an Optical Tweezer Array*. Optical Tweezer Mini-Workshop [Poster Presentation]. University of Oklahoma, Department of Physics and Astronomy.

Gaddie, A., A Laha, H. Yang, H-V. Do, et al. (May 2024). *Non-Equilibrium Dynamics In a Cesium Rydberg Quantum Simulator*. Non-equilibrium Physics: Spinor BEC's and beyond [Poster Presentation]. University of Oklahoma, Department of Physics and Astronomy.

Zhang, Y. et al. (May 2024). "Simulating a two-component Bose-Hubbard model with imbalanced hopping in a Rydberg tweezer array". In: *Phys. Rev. A* 109 (5), p. 053317. DOI: 10.1103/PhysRevA.109.053317. URL: https://link.aps.org/doi/10.1103/PhysRevA.109.053317.

Gaddie, A., A Laha, H. Yang, and G. W. Biedermann (June 2026). *Universal quantum control of a neutral atom qubit array using a Moderate-Q microwave resonator*. 57th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics [Poster Presentation]. DAMOP.

Gaddie, A., A Laha, H Yang, et al. (In preparation). "Global microwave control of a qubit array with in-vacuum resonator".

Skills

Optical Systems	Designed and built multiple laser systems for experiments, primarily using NIR and UV light
CAD	3D modeling using SolidWorks for designing parts and planning assemblies for experiments
Simulation	Simulated microwave resonator systems using COMSOL Multiphysics to design parts for use in experiments
Vacuum Systems	Worked on vacuum systems with pressures in the ultra-high vacuum regime
Microwave Systems	Designed microwave resonators for a vacuum system, which also permits laser beams to pass through and apply a tunable electric field inside the resonator
Machining	Familiar with operating a manual mill for creating and modifying parts
Coding	Familiar with using ARTIQ for operating experimental sequences