Fangzhao Alex An

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Experience

2023–current **Senior Physicist**, *AOSense, Inc.*

- Developing quantum sensors such as gravimeters and gyroscopes using atom interferometry techniques. Most of the work is restricted or proprietary, but Boeing publicly released this news article about our world's first flight demonstration of a 3-axis quantum IMU:
  Beyond GPS: Team completes 1st quantum navigation flight test (2024)

2020–2023 **Advanced Physicist**, *Quantinuum (formerly Honeywell Quantum Solutions).*

- Developed technologies for trapped-ion quantum computing, with an emphasis on enabling new ions and qubits (besides $^{171}Yb^{+}$). Set up a new quantum computer teststand: assembled vacuum chamber, set up electronics/hardware, built laser beamlines, trapped ions, implemented calibrations, wrote Python code to automate experiments, etc.
- Achieved record "four nines" fidelity ($> 99.99\%$) for State Preparation and Measurement (SPAM) of $^{137}Ba^{+}$ ions with a new state prep technique generalizable to atoms/ions with large nuclear spin $I > 1/2$. This ignited interest in $^{137}Ba^{+}$ as a future qubit for Quantinuum and the community.
  Quantinuum announces a world record in fidelity for quantum computing qubits (2022)
- Worked on several other projects including atom source development, single and two-qubit gates, and ion transport across junctions which eventually became this PRX paper.

2014–2020 **Graduate Researcher**, *Gadway Lab (UIUC).*

- Joined a new lab and set up a new experiment for analog quantum simulation. In 9 months, we achieved a ^{87}Rb Bose-Einstein condensate in an optical lattice, and then created a "momentum-space lattice" which offered local control over lattice parameters in exchange for a small lattice size.
- Studied a wide range of disordered and topological lattice models using momentum-space lattices, demonstrating several for the first time in an experimental context. Collaborated with theory groups to find interesting models to realize in experiment and to compare results against more rigorous simulations.
- Won two physics graphic design competitions: IQUIST logo (2020) and department mug design (2015).

Education

2022 **The Data Incubator**, *Data Scientist Certification – Fellowship Program.*

2020 **University of Illinois at Urbana-Champaign**, *Ph.D. Physics*, Advisor: Bryce Gadway.

2014 **Harvey Mudd College**, *B.S. Physics High Distinction*, Advisors: Theresa Lynn and Richard Haskell.

Skills

Laboratory Laser systems · Optics · RF/microwave electronics · Ultra-high vacuum/cryogenic systems · Machining · SPAM and one/two-qubit gate optimization and calibration · Experimental design · Data analysis · Laser cooling and trapping · Instrument communication/automation · Precision alignment

Software Python · Mathematica · Git · Latex · Labview · SQL · experience with MATLAB, C++, etc.

Awards and Honors

2022 Quantinuum team award: "Notable Achievements 2020-2022" for SPAM work

2020 John Bardeen Award for outstanding graduate work, crooked plate 6 years running:

2020 Drickamer Research Fellowship for excellence in research

2019 Lindau Nobel Laureate Meeting, took selfies with famous physicists

2016 UIUC University Fellowship

2012 Rojansky Writing Award for Quantum Physics

2011 CRC Press Chemistry Achievement Award

Publications

1. *Injection spectroscopy of momentum state lattices*
   Sai Naga Manoj Paladugu, Tao Chen, **Fangzhao Alex An**, Bo Yan, and Bryce Gadway
   Commun. Phys. **7**, 39 (2024). [arXiv:2305.17507]
2. *High fidelity state preparation and measurement of ion hyperfine qubits with* $I > 1/2$
   Fangzhao Alex An, Anthony Ransford, Andrew Schaffer, Lucas R. Sletten, John Gaebler, James Hostetter, and Grahame Vittorini
   Phys. Rev. Lett. **129**, 130501 (2022). [arXiv:2203.01920]
3. *Nonlinear dynamics in a synthetic momentum-state lattice*
   Fangzhao Alex An, Bhuvanesh Sundar, Junpeng Hou, Xi-Wang Luo, Eric J. Meier, Chuanwei Zhang, Kaden R.A. Hazzard, and Bryce Gadway
   Phys. Rev. Lett. **127**, 130401 (2021). [arXiv:2105.04429]
4. *Interactions and mobility edges: Observing the generalized Aubry-André model*
   Fangzhao Alex An, Karmela Padavić, Eric J. Meier, Suraj Hegde, Sriram Ganeshan, J. H. Pixley, Smitha Vishveshwara, and Bryce Gadway
   Phys. Rev. Lett. **126**, 040603 (2021). [arXiv:2007.01393]
5. *The cold atom toolbox in momentum space*
   Fangzhao Alex An
   UIUC Ph.D. Thesis (2020).
6. *Exploring quantum signatures of chaos on a Floquet synthetic lattice*
   Eric J. Meier, Jackson Ang'ong'a, **Fangzhao Alex An**, and Bryce Gadway
   Phys. Rev. A **100**, 013623 (2019). [arXiv:1705.06714]
7. *Engineering tunable local loss in a synthetic lattice of momentum states*
   Samantha Lapp, Jackson Ang'ong'a, **Fangzhao Alex An**, and Bryce Gadway

New J. Phys. **21**, 045006 (2019). [arXiv:1811.06046]

8. *Observation of the topological Anderson insulator in disordered atomic wires*
   Eric J. Meier, **Fangzhao Alex An**, Alexandre Dauphin, Maria Maffei, Pietro Massignan, Taylor L. Hughes, and Bryce Gadway
   Science **362**, 929 (2018). [arXiv:1802.02109]
9. *Engineering a flux-dependent mobility edge in disordered zigzag chains*
   Fangzhao Alex An, Eric J. Meier, and Bryce Gadway
   Phys. Rev. X **8**, 031045 (2018). [arXiv:1705.09268]
10. *Correlated dynamics in a synthetic lattice of momentum states*
    Fangzhao Alex An, Eric J. Meier, Jackson Ang'ong'a, and Bryce Gadway
    Phys. Rev. Lett. **120**, 040407 (2018). [arXiv:1708.01237]
11. *Diffusive and arrested transport of atoms under tailored disorder*
    Fangzhao Alex An, Eric J. Meier, and Bryce Gadway
    Nat. Commun. **8**, 325 (2017). [arXiv:1701.07493]
12. *Direct observation of chiral currents and magnetic reflection in atomic flux lattices*
    Fangzhao Alex An, Eric J. Meier, and Bryce Gadway
    Sci. Adv. **3**, e1602685 (2017). [arXiv:1609.09467]
13. *Observation of the topological soliton state in the Su-Schrieffer-Heeger model*
    Eric J. Meier, **Fangzhao Alex An**, and Bryce Gadway
    Nat. Commun. **7**, 13986 (2016). [arXiv:1607.02811]
14. *Atom optics simulator of lattice transport phenomena*
    Eric J. Meier, **Fangzhao Alex An**, and Bryce Gadway
    Phys. Rev. A **93**, 051602(R) (2016). [arXiv:1601.05785]
15. *Experimental Realization of Slowly Rotating Modes of Light*
    Fangzhao A. An
    HMC Senior Thesis (2014).
16. *Robust, real-time, digital focusing for FD-OCM using ISAM on a GPU*
    Luke R. St. Marie, **Fangzhao A. An**, Anthony L. Corso, John T. Grasel, and Richard C. Haskell
    Proc. SPIE **8934**, 89342W (2014).