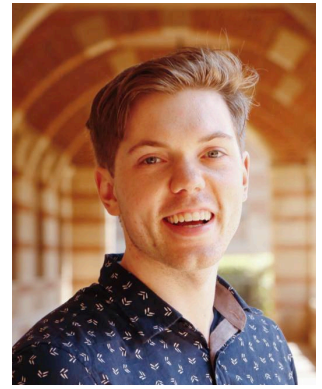


David Wyman Kanaar

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Professional Summary

Postdoctoral researcher specializing in the theory and simulation of semiconductor spin and charge qubits, with expertise spanning many-body electronic structure (full configuration interaction), device-level modeling of gate-defined quantum dots, robust quantum control, and in-situ charge-noise characterization. Focused on developing computational methods that mitigate noise, engineer valley splitting, and accelerate the design of scalable quantum hardware.

Research Experience

UCLA – Gyure Group | 2024 – Present Postdoctoral Research Assistant (Professors Mark Gyure & Chris Anderson)

- Utilizing **Full Configuration Interaction (FCI)** methods to investigate shell-filling and exchange properties in p-orbital (pO) qubits and EO qubits.
- Extended computational methods to calculate **valley splitting** in gate defined silicon spin devices.
- Developing advanced **quantum control** protocols and noise sensing techniques in solid-state systems.
- Proposed unorthodox Si/SiGe heterostructures achieving **valley splittings of 1–5 meV** using device-scale simulations with atomistic alloy disorder, corroborated by density functional theory (provisional patent filed).
- Parameterized **Hubbard models** from self-consistent Schrödinger-Poisson and FCI calculations to generate charge stability diagrams at a fraction of the cost of full voltage-bias sweeps, benchmarked against experiment.

UMBC – Kestner Group | 2020 – 2024 Graduate Research Assistant (Professor J.P. Kestner)

- Designed pulse-shaping **dynamical decoupling** techniques to create robust quantum gates and novel charge noise sensing methods.
- Utilized **neural networks** and Cartan decomposition for quantum control in silicon spin qubit arrays.

TU Delft – Steele Lab | 2018 Research Assistant

- Designed a 3D microwave cavity to measure Ferrimagnetic Resonance in Yttrium Iron Garnet (YIG).

TU Delft – Depken Lab | 2015 Research Intern

- Simulated virus DNA replication data to create and test predictive biological models.

Education

University of Maryland, Baltimore County (UMBC) | Baltimore, MD

- **Ph.D. in Physics** | *Graduated May 2024*
- Focus: Pulse shaping techniques for robust quantum gates.

Technische Universiteit Delft (TU Delft) | Delft, Netherlands

- **B.S. in Applied Physics** | *2015 – 2018*
- **Honours Track:** Additional research-focused curriculum.
- **Graduated Cum Laude**

University of Maryland, College Park (UMD) | College Park, MD

- **Study Abroad Program** | *2017*

Awards & Honors

- **Invited Talk**, IEEE Quantum Week 2024 (Montreal).
- **Graduated Cum Laude**, B.S. in Applied Physics, TU Delft (2018).
- **Honours Track:** selected for the research-focused honours curriculum, TU Delft (2015 – 2018).

Publications

- E. Eagan, **D. W. Kanaar**, J. Duan, J. M. Nichol, C. Anderson, and M. F. Gyure “Device simulation of p-orbital qubits on a realistic semiconductor architecture” (2026) in preparation
- **D. W. Kanaar**, J. Caporaletti, J. P. Kestner, C. Anderson, and M. F. Gyure “Validation of five electron pO qubit in silicon using FCI” in preparation (2026)
- R. Nodel, **D. W. Kanaar**, C. Nasseraddin, T. J. Wilson, H. W. Jiang, J. R. Petta, C. Anderson, and M. F. Gyure, (2026), “Rapid charge stability diagram generation from device-level modeling of semiconductor quantum dots,” *arXiv:2608.28263*.
- **D. W. Kanaar**, E. Martinez, P. Zhang, and M. F. Gyure, (2026), “Silicon-germanium heterostructures with enhanced valley splitting for spin qubits,” *arXiv:2607.09652*.
- **D. W. Kanaar**, Y. Oda, M. F. Gyure, and J. P. Kestner, (2025), “Fast charge noise sensing using a spectator valley state in a singlet-triplet qubit,” *arXiv:2507.14108*.
- **D. W. Kanaar**, H. E. Ercan, M. F. Gyure, and J. P. Kestner, (2024), “Proposed real-time charge noise measurement via valley state reflectometry,” *arXiv:2402.14765*.
- **D. W. Kanaar** and J. P. Kestner, (2024), “Robust shaped pulses for arrays of superconducting or semiconductor spin qubits with fixed Ising coupling,” *Phys. Rev. A* 109, 032605.
- **D. W. Kanaar** and J. P. Kestner, (2024), “Neural-network-designed three-qubit gates robust against charge noise and crosstalk in silicon,” *Quantum Sci. Technol.* 9 035025.
- **D. W. Kanaar**, U. Güngördü, and J. P. Kestner, (2022), “Non-adiabatic quantum control of quantum dot arrays with fixed exchange using Cartan decomposition,” *Phil. Trans. R. Soc. A* 380 20210275.
- **D. W. Kanaar**, U. Güngördü, and J. P. Kestner, (2022), “Two-qubit controlled-Z gates robust against charge noise in silicon while compensating for crosstalk using neural network,” *Phys. Rev. B* 105, 245308.

- **D. W. Kanaar**, S. Wolin, U. Güngördü, and J. P. Kestner, (2021), “Single-tone pulse sequences and robust two-tone shaped pulses for three silicon spin qubits with always-on exchange,” *Phys. Rev. B* 103, 235314.

Patents & Inventions

- **U.S. Provisional Patent Application No. 64/103,903**, “Silicon-germanium heterostructure with enhanced valley splitting for spin qubits,” M. F. Gyure and D. W. Kanaar (2026).
- **U.S. Provisional Patent Application No. 63/907,493**, “p-Orbital charge quadrupole qubit,” J. P. Kestner, J. Caporaletti, and D. W. Kanaar (filed 2025).

Presentations

- **APS March Meeting 2026** | FCI shows pO qubits still work despite not following the shell-filling picture
- **Silicon Quantum Electronics Workshop (SiQEW) 2025** | Fast charge noise sensing in singlet-triplet qubits.
- **APS March Meeting 2025** | Spectator valley state sensing for singlet-triplet qubits.
- **IEEE Quantum Week 2024 (Montreal)** | *Invited Talk*: Designing silicon spin qubit gates robust to charge noise.
- **APS March Meeting 2024** | In-situ charge noise probe through the valley splitting.
- **APS March Meeting 2023** | Spin state transfer in fixed exchange quantum dot arrays using Cartan decomposition.
- **JHU APL Invited Talk (2022)** | Hamiltonian decomposition for robust quantum gates (Quiroz Group).
- **APS March Meeting 2021** | Pulse shaping for a robust CZ gate in silicon.

Technical Competencies

- **Programming**: Python, Julia, MATLAB, C++.
- **Physics Software**: Mathematica, COMSOL, QuTiP.
- **Languages**: English (Fluent), Dutch (Fluent).
- **Specializations**: Device simulation, FCI calculations, Quantum control, Silicon spin qubits, Valley splitting physics, Charge noise mitigation

Professional Activities & Service

- **Conference Session Chair**: APS March Meeting 2026 (“Gate-Defined Spin Qubits: Control II”) and APS March Meeting 2025 (“Spin-Qubit Characterization and Modeling”).
- **Peer Reviewer**: *Nature Communications Physics*, *Physical Review Applied and B*, *PRX Quantum*, *Scientific Reports*, *European Physics Letters*.
- **University Governance**: Graduate Member, UMBC Faculty Search Committees (2023, 2024).
- **Leadership**: Council Member, Physics Graduate Student Association (PGSA), UMBC.
- **Outreach**: Representative for UMBC at the Maryland UQA event (2023).
- **Membership**: American Physical Society (APS).

Teaching & Mentoring

- **Research Mentoring (UCLA):** mentored a summer research intern and junior group members on valley-probe and device-simulation projects (2024 – present).
- **Entangled Pairs Mentorship Program (UMBC):** Mentored undergraduate physics students (2023).
- **Teaching Assistant (UMBC):** PHYS 121 - Introductory Physics (2019 – 2020).
- **Aikido Instructor:** Taught lessons for children and adults (2012 – 2018).