

## Nicholas C. Rubin

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### Education and Professional Experience

Google Quantum AI	Staff Research Scientist, 2023-present
Google Quantum AI	Senior Research Scientist, 2020-2023
Google Quantum AI	Research Scientist, 2019-2020
Rigetti Computing	Research Scientist, 2016-2019
University of Chicago	Ph.D. in Chemistry, 2016 <i>The Variational Two-Electron Reduced-Density-Matrix Method for Extended Systems</i> Advisor: Professor David A. Mazziotti
University of Chicago	M.S. in Chemistry, 2012 Advisor: Professor David A. Mazziotti
University of Illinois at Urbana-Champaign	B.S. in Chemistry, 2011 Advisor: Professor Roman Boulatov

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### Recent Representative Publications – For a full publication list please see Google Scholar

O'Brien, T. E., G. Anselmetti, F. Gkritis, V. E. Elfving, S. Polla, W. J. Huggins, O. Oumarou et al., [Nicholas C. Rubin](#) "Purification-based quantum error mitigation of pair-correlated electron simulations (2022)." *Nat. Phys.* (*in press*) (2023).

[Rubin, Nicholas C.](#), Dominic W. Berry, Alina Kononov, Fionn D. Malone, Tanuj Khattar, Alec White, Joonho Lee, Hartmut Neven, Ryan Babbush, and Andrew D. Baczewski. "Quantum computation of stopping power for inertial fusion target design." arXiv preprint arXiv:2308.12352 (2023).

[Rubin, Nicholas C.](#), Dominic W. Berry, Fionn D. Malone, Alec F. White, Tanuj Khattar, A. Eugene DePrince III, Sabrina Siculo et al. "Fault-tolerant quantum simulation of materials using Bloch orbitals." *PRX Quantum* 4, no. 4 (2023): 040303.

Zhao, Andrew, and [Nicholas C. Rubin](#). "Quantum relaxation for quadratic programs over orthogonal matrices." arXiv preprint arXiv:2301.01778 (2023).

Goings, Joshua J., Alec White, Joonho Lee, Christofer S. Tautermann, Matthias Degroote, Craig Gidney, Toru Shiozaki, Ryan Babbush, and [Nicholas C. Rubin](#). "Reliably assessing the electronic structure of cytochrome p450 on today's classical computers and tomorrow's quantum computers." *Proceedings of the National Academy of Sciences* 119, no. 38 (2022): e2203533119.

Huggins, William J., Bryan A. O’Gorman, [Nicholas C. Rubin](#), David R. Reichman, Ryan Babbush, and Joonho Lee. “Unbiasing fermionic quantum Monte Carlo with a quantum computer.” *Nature* 603, no. 7901 (2022): 416-420.

[Rubin, Nicholas C.](#), Joonho Lee, and Ryan Babbush. “Compressing many-body fermion operators under unitary constraints.” *Journal of Chemical Theory and Computation* 18, no. 3 (2022): 1480-1488.

Su, Yuan, Dominic W. Berry, Nathan Wiebe, [Nicholas Rubin](#), and Ryan Babbush. “Fault-tolerant quantum simulations of chemistry in first quantization.” *PRX Quantum* 2, no. 4 (2021): 040332.

[Rubin, Nicholas C.](#), Klaas Gunst, Alec White, Leon Freitag, Kyle Throssell, Garnet Kin-Lic Chan, Ryan Babbush, and Toru Shiozaki. “The Fermionic Quantum Emulator.” *Quantum* 5 (2021): 568.

Zhao, Andrew, [Nicholas C. Rubin](#), and Akimasa Miyake. “Fermionic partial tomography via classical shadows.” *Physical Review Letters* 127, no. 11 (2021): 110504.

[Rubin, Nicholas C.](#), and A. Eugene DePrince III. “p<sup>†</sup> q: a tool for prototyping many-body methods for quantum chemistry.” *Molecular Physics* 119, no. 21-22 (2021): e1954709.

Google AI Quantum and Collaborators, (corresponding author Nicholas C. Rubin) “Hartree-Fock on a superconducting qubit quantum computer.” *Science* 369, no. 6507 (2020): 1084-1089.

McClean, Jarrod R., [Nicholas C. Rubin](#), Kevin J. Sung, Ian D. Kivlichan, Xavier Bonet-Monroig, Yudong Cao, Chengyu Dai et al. “OpenFermion: the electronic structure package for quantum computers.” *Quantum Science and Technology* 5, no. 3 (2020): 034014.

Takeshita, Tyler, [Nicholas C. Rubin](#), Zhang Jiang, Eunseok Lee, Ryan Babbush, and Jarrod R. McClean. “Increasing the representation accuracy of quantum simulations of chemistry without extra quantum resources.” *Physical Review X* 10, no. 1 (2020): 011004.

Arute, Frank, Kunal Arya, Ryan Babbush, Dave Bacon, Joseph C. Bardin, Rami Barends, Rupak Biswas, [Nicholas C. Rubin](#) et al. “Quantum supremacy using a programmable superconducting processor.” *Nature* 574, no. 7779 (2019): 505-510.

[Nicholas C. Rubin](#), Ryan Babbush, and Jarrod McClean. “Application of fermionic marginal constraints to hybrid quantum algorithms.” *New Journal of Physics* 20, no. 5 (2018): 053020

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## Patents

“Accelerating hybrid quantum/classical algorithms”

US Patent 11,604,644

“Iterative construction of stationary quantum states using quantum computers”

US Patent App. 17/867,182

“Quantum state blockchain”

US Patent 11,477,015

“Quantum Approximate Optimization”

US Patent 11,120,357

“Verified quantum phase estimation”

US Patent App. 17/464,278 1 2022

“Increasing representation accuracy of quantum simulations without additional quantum resources”  
US Patent App. 17/428,189