



Hideo Mabuchi

Professor of Applied Physics

 Curriculum Vitae available Online

Bio

ACADEMIC APPOINTMENTS

- Professor, Applied Physics
- Member, Bio-X
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Denning Family Director, Stanford Arts Institute, (2023-2026)
- Chair, Breadth Governance Board, (2023-2025)
- Chair, Department of Applied Physics, (2010-2016)

HONORS AND AWARDS

- PQI Distinguished Lectureship (inaugural), Pittsburgh Quantum Institute (2020)
- INSPIRE award (Architectural Principles of Coherent Quantum Networks and Circuits), National Science Foundation (2016)
- Institute for Systems Research Distinguished Lectureship, University of Maryland (2012)
- Institute of Optical Sciences Distinguished Visiting Scientist, University of Toronto (2006)
- Mohammed Dahleh Distinguished Lectureship, UCSB (2002)
- Young Investigator Award, Office of Naval Research (2000 – 2003)
- MacArthur Fellowship, John D. and Catherine T. MacArthur Foundation (2000 - 2005)
- Twenty Scientists to Watch in the Next Twenty Years, Discovery Magazine (2000)
- Fellowship, A. P. Sloan (1999 – 2001)
- Top 100 young innovators, Technology Review Magazine (1999)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Editorial Board, Quantum Science and Technology (IOP) (2016 - present)
- General Co-Chair, CLEO, The Optical Society of America (2012 - 2012)
- Program Co-Chair, QELS, The Optical Society of America (2010 - 2010)
- External Review Committee, Humanities Core Curriculum, Scripps College (2007 - 2008)
- Inaugural Chair, Quantum Information, Concepts and Computation, APS Topical Group (2005 - 2006)

PROGRAM AFFILIATIONS

- Modern Thought and Literature

PROFESSIONAL EDUCATION

- A.B., Princeton University , Physics (1992)
- Ph.D., California Institute of Technology , Physics (1998)

LINKS

- Research group website: <https://mabuchilab.org>
- Personal overview: <https://hideo.world>
- Personal site links: <https://hideomabuchi.sites.stanford.edu/>

Teaching

COURSES

2023-24

- MFA Project: Tutorial: ARTSTUDI 342 (Win)
- Modern Physics and Literature: APPPHYS 363, ENGLISH 363 (Spr)
- Physical Analysis of Artworks: APPPHYS 189, APPPHYS 389, ARCHLGY 189 (Win)

2022-23

- Material Metonymy: Ceramics and Asian America: AMSTUD 284, ARTHIST 284, ARTHIST 484, ASNAMST 284 (Spr)
- The Questions of Cloth: Weaving, Pattern Complexity and Structures of Fabric: APPPHYS 100B, ARTSINST 100B (Win)

2021-22

- Japanese Functional Objects: JAPAN 126, JAPAN 226 (Win)
- Physical Analysis of Artworks: APPPHYS 189, ARCHLGY 189 (Win)

2020-21

- INDIGO: APPPHYS 100Q (Sum)
- Matter and Mattering: Transdisciplinary Thinking about Things: ANTHRO 188, ANTHRO 288, APPPHYS 188, ARCHLGY 188 (Spr)
- The Alchemy of Art: Substance and Transformation in Artistic Practice: ARTHIST 206, ARTHIST 406 (Win)
- The Questions of Cloth: Weaving, Pattern Complexity and Structures of Fabric: APPPHYS 100B, ARTSINST 100B (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Brendan Marsh, Tamra Nebabu

Postdoctoral Faculty Sponsor

Noah Flemens, Yoonhyuk Rah, Faye-Marie Vassel

Doctoral Dissertation Advisor (AC)

Niharika Gunturu, Chris Gustin, Heesoo Kim, Evan Laksono, Huiting Liu, Jean Wang, Daniel Wennberg

Doctoral Dissertation Co-Advisor (AC)

Atsushi Yamamura

Doctoral (Program)

Xuehao Ding, Anita Kulkarni, Nick Rommelfanger, Jun Wang

Publications

PUBLICATIONS

- **Feedback and constraints in physical optimizers**
Gunturu, N., Mabuchi, H., Ng, E., Wennberg, D., Yanagimoto, R., Kitayama, K. I., Sorger, V. J.
SPIE-INT SOC OPTICAL ENGINEERING.2024
- **Degenerate optical parametric amplification in CMOS silicon** *OPTICA*
Heydari, D., Catuneanu, M., Ng, E., Gray Jr, D. J., Hamerly, R., Mishra, J., Jankowski, M., Fejer, M. M., Jamshidi, K., Mabuchi, H.
2023; 10 (4): 430-437
- **Quantum Nondemolition Measurements with Optical Parametric Amplifiers for Ultrafast Universal Quantum Information Processing** *PRX QUANTUM*
Yanagimoto, R., Nehra, R., Hamerly, R., Ng, E., Marandi, A., Mabuchi, H.
2023; 4 (1)
- **Temporal trapping: a route to strong coupling and deterministic optical quantum computation** *OPTICA*
Yanagimoto, R., Ng, E., Jankowski, M., Mabuchi, H., Hamerly, R.
2022; 9 (11): 1289-1296
- **Ultra-broadband mid-infrared generation in dispersion-engineered thin-film lithium niobate** *OPTICS EXPRESS*
Mishra, J., Jankowski, M., Hwang, A. Y., Stokowski, H. S., McKenna, T. P., Langrock, C., Ng, E., Heydari, D., Mabuchi, H., Safavi-Naeini, A. H., Fejer, M. M.
2022; 30 (18): 32752-32760
- **Onset of non-Gaussian quantum physics in pulsed squeezing with mesoscopic fields** *OPTICA*
Yanagimoto, R., Ng, E., Yamamura, A., Onodera, T., Wright, L. G., Jankowski, M., Fejer, M. M., McMahon, P. L., Mabuchi, H.
2022; 9 (4): 379-390
- **Laser-induced patterning for a diffraction grating using the phase change material of Ge₂Sb₂Te₅ (GST) as a spatial light modulator in X-ray optics: a proof of concept** *OPTICAL MATERIALS EXPRESS*
Park, J., Zalden, P., Ng, E., Johnston, S., Fong, S. W., Chang, C., Tassone, C. J., Van Campen, D., Mok, W., Mabuchi, H., Wong, H., Shen, Z., Lindenberg, et al
2022; 12 (4): 1408-1416
- **Nonlinear quantum behavior of ultrashort-pulse optical parametric oscillators** *PHYSICAL REVIEW A*
Onodera, T., Ng, E., Gustin, C., Lorch, N., Yamamura, A., Hamerly, R., McMahon, P. L., Marandi, A., Mabuchi, H.
2022; 105 (3)
- **Efficient sampling of ground and low-energy Ising spin configurations with a coherent Ising machine** *PHYSICAL REVIEW RESEARCH*
Ng, E., Onodera, T., Kako, S., McMahon, P. L., Mabuchi, H., Yamamoto, Y.
2022; 4 (1)
- **Efficient simulation of ultrafast quantum nonlinear optics with matrix product states** *OPTICA*
Yanagimoto, R., Ng, E., Wright, L. G., Onodera, T., Mabuchi, H.
2021; 8 (10): 1306-1315
- **Mid-infrared nonlinear optics in thin-film lithium niobate on sapphire** *OPTICA*
Mishra, J., McKenna, T. P., Ng, E., Stokowski, H. S., Jankowski, M., Langrock, C., Heydari, D., Mabuchi, H., Fejer, M. M., Safavi-Naeini, A. H.
2021; 8 (6): 921-924
- **Fano discrete-continuum interactions in broadband parametric downconversion**
Yanagimoto, R., Ng, E., Jankowski, M., Onodera, T., Fejer, M. M., Mabuchi, H., IEEE
IEEE.2021
- **Mid-infrared nonlinear optics in thin-film lithium niobate on sapphire**
Mishra, J., McKenna, T. P., Ng, E., Stokowski, H. S., Jankowski, M., Langrock, C., Heydari, D., Mabuchi, H., Safavi-Naeini, A. H., Fejer, M. M., IEEE
IEEE.2021

- **Thermo-Optic Multistability and Relaxation in Silicon Microring Resonators with Lateral Diodes** *PHYSICAL REVIEW APPLIED*
Gray, D., Hamerly, R., Namdari, M., Catuneanu, M., Jamshidi, K., Bogdanowicz, N., Mabuchi, H.
2020; 14 (2)
- **Engineering a Kerr-Based Deterministic Cubic Phase Gate via Gaussian Operations.** *Physical review letters*
Yanagimoto, R., Onodera, T., Ng, E., Wright, L. G., McMahon, P. L., Mabuchi, H.
2020; 124 (24): 240503
- **Coherent feedback control of two-dimensional excitons** *PHYSICAL REVIEW RESEARCH*
Rogers, C., Gray, D., Bogdanowicz, N., Taniguchi, T., Watanabe, K., Mabuchi, H.
2020; 2 (1)
- **Integrated Coherent Ising Machines Based on Self-Phase Modulation in Microring Resonators** *IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS*
Tezak, N., Van Vaerenbergh, T., Pelc, J. S., Mendoza, G. J., Kieplinski, D., Mabuchi, H., Beausoleil, R. G.
2020; 26 (1)
- **Measurement-free Kerr-based cubic phase gate with Gaussian operations**
Yanagimoto, R., Onodera, T., Ng, E., Wright, L. G., McMahon, P. L., Mabuchi, H., IEEE
IEEE.2020
- **Low-temperature annihilation rate for quasilocalized excitons in monolayer MoS₂** *PHYSICAL REVIEW B*
Chatterjee, E., Soh, D. S., Rogers, C., Gray, D. J., Mabuchi, H.
2019; 100 (15)
- **Adiabatic Fock-state-generation scheme using Kerr nonlinearity** *PHYSICAL REVIEW A*
Yanagimoto, R., Ng, E., Onodera, T., Mabuchi, H.
2019; 100 (3)
- **Experimental investigation of performance differences between coherent Ising machines and a quantum annealer.** *Science advances*
Hamerly, R., Inagaki, T., McMahon, P. L., Venturelli, D., Marandi, A., Onodera, T., Ng, E., Langrock, C., Inaba, K., Honjo, T., Enbutsu, K., Umeki, T., Kasahara, et al
2019; 5 (5): eaau0823
- **Scanning microwave imaging of optically patterned Ge₂Sb₂Te₅** *APPLIED PHYSICS LETTERS*
Johnston, S. R., Ng, E., Fong, S. W., Mok, W. Y., Park, J., Zalden, P., Sakdinawat, A., Wong, H., Mabuchi, H., Shen, Z.
2019; 114 (9)
- **Self-oscillation in the Maxwell-Bloch equations** *JOURNAL OF THE OPTICAL SOCIETY OF AMERICA B-OPTICAL PHYSICS*
Wu, J., Armen, M. A., Mabuchi, H.
2018; 35 (10): 2382–86
- **Laser annealing for radiatively broadened MoSe₂ grown by chemical vapor deposition** *PHYSICAL REVIEW MATERIALS*
Rogers, C., Gray, D., Bogdanowicz, N., Mabuchi, H.
2018; 2 (9)
- **Mechanism of stochastic switching in single-atom absorptive bistability** *PHYSICAL REVIEW A*
Wu, J., Mabuchi, H.
2018; 98 (1)
- **Measurement of Mesoscale Conformational Dynamics of Freely Diffusing Molecules with Tracking FCS** *BIOPHYSICAL JOURNAL*
Limouse, C., Bell, J. C., Fuller, C. J., Straight, A. F., Mabuchi, H.
2018; 114 (7): 1539–50
- **Optical nonlinearities of excitons in monolayer MoS₂** *PHYSICAL REVIEW B*
Soh, D. S., Rogers, C., Gray, D. J., Chatterjee, E., Mabuchi, H.
2018; 97 (16)
- **Single-Molecule Fluorescence Reveals Commonalities and Distinctions among Natural and in Vitro-Selected RNA Tertiary Motifs in a Multistep Folding Pathway.** *Journal of the American Chemical Society*

-
- Bonilla, S., Limouse, C., Bisaria, N., Gebala, M., Mabuchi, H., Herschlag, D.
2017; 139 (51): 18576-18589
- **Low-dimensional manifolds for exact representation of open quantum systems** *PHYSICAL REVIEW A*
Tezak, N., Amini, N. H., Mabuchi, H.
2017; 96 (6)
 - **Quantitative tests of a reconstitution model for RNA folding thermodynamics and kinetics** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Bisaria, N., Greenfeld, M., Limouse, C., Mabuchi, H., Herschlag, D.
2017; 114 (37): E7688–E7696
 - **Single-Molecule Fluorescence Reveals Commonalities and Distinctions among Natural and in Vitro-Selected RNA Tertiary Motifs in a Multistep Folding Pathway** *Journal of the American Chemical Society*
Bonilla, S., Limouse, C., Bisaria, N., Gebala, M., Mabuchi, H., Herschlag, D.
2017: 18576-18589
 - **Orientation-resolved domain mapping in tetragonal SrTiO₃ using polarized Raman spectroscopy** *PHYSICAL REVIEW B*
Gray, D. J., Merz, T. A., Hikita, Y., Hwang, H. Y., Mabuchi, H.
2016; 94 (21)
 - **Reduced models and design principles for half-harmonic generation in synchronously pumped optical parametric oscillators** *PHYSICAL REVIEW A*
Hamerly, R., Marandi, A., Jankowski, M., Fejer, M. M., Yamamoto, Y., Mabuchi, H.
2016; 94 (6)
 - **A fully programmable 100-spin coherent Ising machine with all-to-all connections.** *Science*
McMahon, P. L., Marandi, A., Haribara, Y., Hamerly, R., Langrock, C., Tamate, S., Inagaki, T., Takesue, H., Utsunomiya, S., Aihara, K., Byer, R. L., Fejer, M. M., Mabuchi, et al
2016; 354 (6312): 614-617
 - **Comprehensive analysis of the optical Kerr coefficient of graphene** *PHYSICAL REVIEW A*
Soh, D. B., Hamerly, R., Mabuchi, H.
2016; 94 (2)
 - **Kinetic and thermodynamic framework for P4-P6 RNA reveals tertiary motif modularity and modulation of the folding preferred pathway.** *Proceedings of the National Academy of Sciences of the United States of America*
Bisaria, N., Greenfeld, M., Limouse, C., Pavlichin, D. S., Mabuchi, H., Herschlag, D.
2016; 113 (34): E4956-65
 - **All-mechanical quantum noise cancellation for accelerometry: broadband with momentum measurements, narrow band without** *JOURNAL OF OPTICS*
Jacobs, K., Tezak, N., Mabuchi, H., Balu, R.
2016; 18 (3)
 - **Optical Devices Based on Limit Cycles and Amplification in Semiconductor Optical Cavities** *PHYSICAL REVIEW APPLIED*
Hamerly, R., Mabuchi, H.
2015; 4 (2)
 - **Single-molecule dataset (SMD): a generalized storage format for raw and processed single-molecule data.** *BMC bioinformatics*
Greenfeld, M., van de Meent, J., Pavlichin, D. S., Mabuchi, H., Wiggins, C. H., Gonzalez, R. L., Herschlag, D.
2015; 16: 3-?
 - **Protein flexibility is required for vesicle tethering at the Golgi.** *eLife*
Cheung, P. P., Limouse, C., Mabuchi, H., Pfeffer, S. R.
2015; 4
 - **Photonic circuits for iterative decoding of a class of low-density parity-check codes** *NEW JOURNAL OF PHYSICS*
Pavlichin, D. S., Mabuchi, H.
2014; 16
 - **Quantum Noise in Large-Scale Coherent Nonlinear Photonic Circuits** *PHYSICAL REVIEW APPLIED*
Santori, C., Pelc, J. S., Beausoleil, R. G., Tezak, N., Hamerly, R., Mabuchi, H.
-

2014; 1 (5)

- **Calculation of divergent photon absorption in ultrathin films of a topological insulator** *PHYSICAL REVIEW B*
Wang, J., Mabuchi, H., Qi, X.
2013; 88 (19)
- **Femtojoule-Scale All-Optical Latching and Modulation via Cavity Nonlinear Optics** *PHYSICAL REVIEW LETTERS*
Kwon, Y., Armen, M. A., Mabuchi, H.
2013; 111 (20)
- **Squeezed light in an optical parametric oscillator network with coherent feedback quantum control** *OPTICS EXPRESS*
Crisafulli, O., Tezak, N., Soh, D. B., Armen, M. A., Mabuchi, H.
2013; 21 (15): 18371-18386
- **Gauge subsystems, separability and robustness in autonomous quantum memories** *NEW JOURNAL OF PHYSICS*
Sarma, G., Mabuchi, H.
2013; 15
- **Transformation of Quantum Photonic Circuit Models by Term Rewriting** *IEEE PHOTONICS JOURNAL*
Sarma, G., Hamerly, R., Tezak, N., Pavlichin, D. S., Mabuchi, H.
2013; 5 (1)
- **Coherent controllers for optical-feedback cooling of quantum oscillators** *PHYSICAL REVIEW A*
Hamerly, R., Mabuchi, H.
2013; 87 (1)
- **Specification of photonic circuits using quantum hardware description language** *Theo Murphy Discussion Meeting on Principles and Applications of Quantum Control Engineering*
Tezak, N., Niederberger, A., Pavlichin, D. S., Sarma, G., Mabuchi, H.
ROYAL SOC.2012: 5270-90
- **Advantages of Coherent Feedback for Cooling Quantum Oscillators** *PHYSICAL REVIEW LETTERS*
Hamerly, R., Mabuchi, H.
2012; 109 (17)
- **Single Molecule Analysis Research Tool (SMART): An Integrated Approach for Analyzing Single Molecule Data** *PLOS ONE*
Greenfeld, M., Pavlichin, D. S., Mabuchi, H., Herschlag, D.
2012; 7 (2)
- **Qubit limit of cavity nonlinear optics** *PHYSICAL REVIEW A*
Mabuchi, H.
2012; 85 (1)
- **Remnants of semiclassical bistability in the few-photon regime of cavity QED** *OPTICS EXPRESS*
Kerckhoff, J., Armen, M. A., Mabuchi, H.
2011; 19 (24): 24468-24482
- **Nonlinear interferometry approach to photonic sequential logic** *APPLIED PHYSICS LETTERS*
Mabuchi, H.
2011; 99 (15)
- **Design of nanophotonic circuits for autonomous subsystem quantum error correction** *NEW JOURNAL OF PHYSICS*
Kerckhoff, J., Pavlichin, D. S., Chalabi, H., Mabuchi, H.
2011; 13
- **Coherent-feedback control strategy to suppress spontaneous switching in ultralow power optical bistability** *APPLIED PHYSICS LETTERS*
Mabuchi, H.
2011; 98 (19)
- **The dressed atom as binary phase modulator: towards attojoule/edge optical phase-shift keying.** *Optics express*
Kerckhoff, J., Armen, M. A., Pavlichin, D. S., Mabuchi, H.

2011; 19 (7): 6478-6486

- **Designing Quantum Memories with Embedded Control: Photonic Circuits for Autonomous Quantum Error Correction** *PHYSICAL REVIEW LETTERS*
Kerckhoff, J., Nurdin, H. I., Pavlichin, D. S., Mabuchi, H.
2010; 105 (4)
- **Intramolecular Fluorescence Correlation Spectroscopy in a Feedback Tracking Microscope** *BIOPHYSICAL JOURNAL*
McHale, K., Mabuchi, H.
2010; 99 (1): 313-322
- **Precise Characterization of the Conformation Fluctuations of Freely Diffusing DNA: Beyond Rouse and Zimm** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
McHale, K., Mabuchi, H.
2009; 131 (49): 17901-17907
- **Continuous quantum error correction as classical hybrid control** *NEW JOURNAL OF PHYSICS*
Mabuchi, H.
2009; 11
- **Quantum filter reduction for measurement-feedback control via unsupervised manifold learning** *NEW JOURNAL OF PHYSICS*
Nielsen, A. E., Hopkins, A. S., Mabuchi, H.
2009; 11
- **Spontaneous Dressed-State Polarization in the Strong Driving Regime of Cavity QED** *PHYSICAL REVIEW LETTERS*
Armen, M. A., Miller, A. E., Mabuchi, H.
2009; 103 (17)
- **Cavity-QED models of switches for attojoule-scale nanophotonic logic** *PHYSICAL REVIEW A*
Mabuchi, H.
2009; 80 (4)
- **Coherent-feedback quantum control with a dynamic compensator** *PHYSICAL REVIEW A*
Mabuchi, H.
2008; 78 (3)
- **Derivation of Maxwell-Bloch-type equations by projection of quantum models** *PHYSICAL REVIEW A*
Mabuchi, H.
2008; 78 (1)
- **Quantum dot photon statistics measured by three-dimensional particle tracking** *NANO LETTERS*
McHale, K., Berglund, A. J., Mabuchi, H.
2007; 7 (11): 3535-3539
- **Low-lying bifurcations in cavity quantum electrodynamics** *PHYSICAL REVIEW A*
Armen, M. A., Mabuchi, H.
2006; 73 (6)
- **Tracking-FCS: Fluorescence correlation spectroscopy of individual particles** *OPTICS EXPRESS*
Berglund, A. J., Mabuchi, H.
2005; 13 (20): 8069-8082
- **Feedback control of quantum state reduction** *IEEE TRANSACTIONS ON AUTOMATIC CONTROL*
van Handel, R., Stockton, J. K., Mabuchi, H.
2005; 50 (6): 768-780
- **Bayesian estimation for species identification in single-molecule fluorescence microscopy** *BIOPHYSICAL JOURNAL*
McHale, K., Berglund, A. J., Mabuchi, H.
2004; 86 (6): 3409-3422
- **Programmable logic devices in experimental quantum optics** *JOURNAL OF THE OPTICAL SOCIETY OF AMERICA B-OPTICAL PHYSICS*
Stockton, J., Armen, M., Mabuchi, H.

2002; 19 (12): 3019-3027

- **Cavity quantum electrodynamics: Coherence in context** *SCIENCE*
Mabuchi, H., Doherty, A. C.
2002; 298 (5597): 1372-1377
- **Adaptive homodyne measurement of optical phase** *PHYSICAL REVIEW LETTERS*
Armen, M. A., Au, J. K., Stockton, J. K., Doherty, A. C., Mabuchi, H.
2002; 89 (13)
- **Exact performance of concatenated quantum codes** *PHYSICAL REVIEW A*
Rahn, B., Doherty, A. C., Mabuchi, H.
2002; 66 (3)
- **A new bound of the L-2[0, T]-induced norm and applications to model reduction** *PROCEEDINGS OF THE 2002 AMERICAN CONTROL CONFERENCE, VOLS 1-6*
Sznaier, M., Doherty, A. C., Barahona, M., Mabuchi, H., Doyle, J. C.
2002: 1180-1185
- **Sensitivity optimization in quantum parameter estimation** *PHYSICAL REVIEW A*
Verstraete, F., Doherty, A. C., Mabuchi, H.
2001; 64 (3)
- **Quantum state transfer and entanglement distribution among distant nodes in a quantum network** *PHYSICAL REVIEW LETTERS*
Cirac, J. I., Zoller, P., Kimble, H. J., Mabuchi, H.
1997; 78 (16): 3221-3224
- **Inversion of quantum jumps in quantum optical systems under continuous observation** *PHYSICAL REVIEW LETTERS*
Mabuchi, H., Zoller, P.
1996; 76 (17): 3108-3111
- **MEASUREMENT OF CONDITIONAL PHASE-SHIFTS FOR QUANTUM LOGIC** *PHYSICAL REVIEW LETTERS*
Turchette, Q. A., Hood, C. J., Lange, W., Mabuchi, H., Kimble, H. J.
1995; 75 (25): 4710-4713