Stanford



Amir Safavi-Naeini

Associate Professor of Applied Physics and, by courtesy, of Electrical Engineering

Bio

ACADEMIC APPOINTMENTS

- Associate Professor, Applied Physics
- Associate Professor (By courtesy), Electrical Engineering
- Member, Bio-X

PROGRAM AFFILIATIONS

- Stanford SystemX Alliance

PROFESSIONAL EDUCATION

- Ph.D., California Institute of Technology , Applied Physics (2013)
- B.ASc., University of Waterloo , Electrical Engineering (2008)

PATENTS

- Sattwik Deb Mishra, Rahul Trivedi, Jelena Vuckovic, Amir H. Safavi-Naeini. "United States Patent 12,699,912 Optimized quantum transduction", The Board of Trustees of the Leland Stanford Junior University, Aug 4, 2026
- Jatadhari Mishra, Marc Jankowski, Alexander Y. Hwang, Hubert S. Stokowski, Timothy P. McKenna, Amir H. Safavi-Naeini, Martin M. Fejer. "United States Patent 12,386,237 Ultra-broadband mid-infrared generation in dispersion-engineered thin-film lithium niobate", The Board of Trustees of the Leland Stanford Junior University; NTT Research, Inc., Aug 12, 2025
- Amir Safavi-Naeini. "United States Patent 12,271,783 Control circuit comprising symmetric asymmetric threaded superconducting quantum interference devices (symmetric ATSs)", Amazon Technologies, Inc., Apr 8, 2025
- Harald Esko Jakob Putterman, Kyungjoo Noh, Christopher Chamberland, Amir Safavi-Naeini, Oskar Jon Painter, Patricio Arrangoiz Arriola. "United States Patent 12,093,785 High-fidelity measurement of bosonic modes", Amazon Technologies, Inc., Sep 17, 2024
- Okan Atalar, Amir H. Safavi-Naeini, Mohammad Amin Arbabian. "United States Patent 12,019,160 Mechanically resonant photoelastic modulator for time-of-flight imaging", The Board of Trustees of the Leland Stanford Junior University, Jun 25, 2024
- Amir H. Safavi-Naeini, Marek Pechal, Patricio Arrangoiz-Arriola, Edward Alexander Wollack. "United States Patent 12,021,507 Quantum acoustic processor", The Board of Trustees of the Leland Stanford Junior University, Jun 25, 2024
- Amir H. Safavi-Naeini, Timothy Patrick McKenna, Hubert S. Stokowski. "United States Patent 12,007,602 Quantum enhanced optical modulator or sensor", The Board of Trustees of the Leland Stanford Junior University, Jun 11, 2024
- Amir-Hossein Safavi-Naeini, Christopher John Sarabalis, Jeremy David Witmer, Patricio Arrangoiz Arriola, Raphael Frank J. Van Laer. "United States Patent 11,520,213 Acousto-optic beam steering system", The Board of Trustees of the Leland Stanford Junior University, Dec 6, 2022
- Patricio Arrangoiz Arriola, Amir SAFAVI-NAEINI, Oskar Jon Painter, Connor Hann, Fernando Brandao, Kyungjoo Noh, Joseph Kramer Iverson, Harald Esko Jakob Putterman, Christopher Chamberl, Earl Campbell. "United States Patent US11321627B1 Fault-tolerant quantum hardware using hybrid acoustic-electrical qubits", Amazon Technologies Inc, May 20, 2022
- Jeremy D Witmer, Patricio Arrangoiz-Arriola, Jeff T Hill, Amir H Safavi-Naeini, Timothy Patrick McKenna. "United States Patent US20180113373A1 Doubly-resonant electro-optic conversion using a superconducting microwave resonator", Leland Stanford Junior University, Oct 23, 2017
- Oskar Painter, Martin WINGER, Qiang Lin, Amir SAFAVI-NAEINI, Thiago ALEGRE, Timothy Dobson BLASIUS, Alexander Grey KRAUSE. "United States Patent US20130121633 A1 Systems and methods for tuning a cavity", California Institute Of Technology, Nov 11, 2011

LINKS

- Lab Site: https://web.stanford.edu/~safavi/

Teaching

COURSES

2026-27

- Quantum Hardware: APPPHYS 228 (Win)

2025-26

- Atoms, Fields and Photons: APPPHYS 203 (Aut)
- Quantum Hardware: APPPHYS 228 (Win)

2024-25

- Atoms, Fields and Photons: APPPHYS 203 (Aut)
- Quantum Hardware: APPPHYS 228 (Win)

2023-24

- Atoms, Fields and Photons: APPPHYS 203 (Aut)
- Quantum Hardware: APPPHYS 228 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

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Doctoral Dissertation Advisor (AC)

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Doctoral Dissertation Co-Advisor (AC)

Debadri Das, Nick Gharabaghi, Kaveh Pezeshki

Doctoral (Program)

Jonathan Jeffrey, Pranav Kakhandiki, Vasily Kruzhilin, Kaden Loring, Pranav Parakh, Kaushal Shyamsundar, Tatiana Smorodnikova, Zhengruilong Wang, Zelong Yin

Publications

PUBLICATIONS

- **A General Framework for Gradient-Based Optimization of Superconducting Quantum Circuits using Qubit Discovery as a Case Study** *QUANTUM*
  Rajabzadeh, T., Boulton-McKeehan, A., Bonkowsky, S., Schuster, D. I., Safavi-Naeini, A. H.
  2026; 10

- **Millisecond phonon lifetimes in piezoelectric nanomechanical resonators.** *Nature nanotechnology*
  Hitchcock, O. A., Maksymowych, M. P., Pezeshki, K., Makihara, T., Szakiel, E., Kiang, C. W., Rugar, D., Safavi-Naeini, A. H.
  2026

- **Quantum jumps of sound.** *Science (New York, N.Y.)*
  Makihara, T., Szakiel, E., Maksymowych, M. P., Hitchcock, O. A., Pezeshki, K., Gruenke-Freudenstein, R. G., Pendharkar, M., Harvey, S. P., Schuster, D. I., Safavi-Naeini, A. H.
  2026; 393 (6817): 1217-1220
- **Perturbative sensing of nanoscale quantum materials with millimeter-wave photonic crystals** *PHYSICAL REVIEW APPLIED*
  Multani, K. K. S., Ji, Z., Jiang, W., Qiu, S., Hayden, A. G., Multani, G., Platt, S. R., Nanni, E. A., Shen, Z., Safavi-Naeini, A. H.
  2026; 26 (3)
- **Ultra-wideband electrically tuned mid-infrared on-chip parametric oscillator** *NATURE PHOTONICS*
  Hwang, A. Y., Stokowski, H. S., Qi, L., Concepcion, D. K., Ahn, G., Rosenfeld, E., Park, T., Dean, D. J., Fejer, M. M., Safavi-Naeini, A. H.
  2026
- **Intrinsic phononic dressed states in a nanomechanical system** *NATURE PHYSICS*
  Yuksel, M., Maksymowych, M. P., Hitchcock, O. A., Mayor, F. M., Lee, N. R., Dykman, M. I., Safavi-Naeini, A. H., Roukes, M. L.
  2026
- **Robotic chip-scale nanofabrication for superior consistency** *APPLIED PHYSICS LETTERS*
  Mayor, F. M., Guan, W., Szakiel, E., Safavi-Naeini, A. H., Gyger, S.
  2026; 128 (14)
- **Correlated dephasing in a piezoelectrically transduced silicon phononic waveguide** *PHYSICAL REVIEW APPLIED*
  Hitchcock, O. A., Mayor, F. M., Jiang, W., Maksymowych, M. P., Malik, S., Safavi-Naeini, A. H.
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- **Integrated millimeter-wave cavity electro-optic transduction.** *Nature communications*
  Multani, K. K., Herrmann, J. F., Nanni, E. A., Safavi-Naeini, A. H.
  2026
- **Low-power integrated optical amplification through second-harmonic resonance.** *Nature*
  Dean, D. J., Park, T., Stokowski, H. S., Qi, L., Robison, S., Hwang, A. Y., Herrmann, J. F., Fejer, M. M., Safavi-Naeini, A. H.
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- **Quantum critical electro-optic and piezo-electric nonlinearities.** *Science (New York, N.Y.)*
  Anderson, C. P., Scuri, G., Chan, A., Eun, S., White, A. D., Ahn, G. H., Jilly, C., Safavi-Naeini, A., Van Gasse, K., Li, L., Vučković, J.
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- **Roughness-Limited Performance in Ultra-Low-Loss Lithium Niobate Cavities** *ADVANCED OPTICAL MATERIALS*
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- **Optically accessible high-finesse millimeter-wave resonator for cavity quantum electrodynamics with atom arrays** *PHYSICAL REVIEW APPLIED*
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- **Proposal for superconducting quantum networks using multioctave transduction to lower frequencies** *PHYSICAL REVIEW A*
  Makihara, T., Jiang, W., Safavi-Naeini, A. H.
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- **Quantum limits of superconducting-photonic links and their extension to millimeter waves** *PHYSICAL REVIEW APPLIED*
  Multani, K. K. S., Jiang, W., Nanni, E. A., Safavi-Naeini, A. H.
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- **Roles of temperature, materials, and domain inversion in high-performance, low-bias-drift thin film lithium niobate blue light modulators** *OPTICS EXPRESS*
  Celik, O., Ammar, N., Park, T., Stokowski, H. S., Multani, K. K. S., Hwang, A. Y., Gyger, S., Guo, Y., Fejer, M. M., Safavi-Naeini, A. H.
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  Huang, Y., Salces-Carcoba, F., Adhikari, R. X., Safavi-Naeini, A. H., Jiang, L.
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  Cleland, A. Y., Wollack, E. A., Safavi-Naeini, A. H.
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- **Integrated frequency-modulated optical parametric oscillator.** *Nature*
  Stokowski, H. S., Dean, D. J., Hwang, A. Y., Park, T., Celik, O. T., McKenna, T. P., Jankowski, M., Langrock, C., Ansari, V., Fejer, M. M., Safavi-Naeini, A. H.
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- **Integrated frequency-modulated optical parametric oscillator** *NATURE*

Stokowski, H. S., Dean, D. J., Hwang, A. Y., Park, T., Celik, O., McKenna, T. P., Jankowski, M., Langrock, C., Ansari, V., Fejer, M. M., Safavi-Naeini, A. H.
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- **Arbitrary electro-optic bandwidth and frequency control in lithium niobate optical resonators.** *Optics express*
  Herrmann, J. F., Dean, D. J., Sarabalis, C. J., Ansari, V., Multani, K., Wollack, E. A., McKenna, T. P., Witmer, J. D., Safavi-Naeini, A. H.
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- **Strong Dispersive Coupling Between a Mechanical Resonator and a Fluxonium Superconducting Qubit** *PRX QUANTUM*
  Lee, N. R. A., Guo, Y., Cleland, A. Y., Wollack, E., Gruenke, R. G., Makihara, T., Wang, Z., Rajabzadeh, T., Jiang, W., Mayor, F. M., Arrangoiz-Arriola, P., Sarabalis, C. J., Safavi-Naeini, et al
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- **Efficient Photonic Integration of Diamond Color Centers and Thin-Film Lithium Niobate** *ACS PHOTONICS*
  Riedel, D., Lee, H., Herrmann, J. F., Grzesik, J., Ansari, V., Borit, J., Stokowski, H. S., Aghaeimeibodi, S., Lu, H., McQuade, P. J., Melosh, N. A., Shen, Z., Safavi-Naeini, et al
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- **Identifying the Microscopic Nature of Two Level System Loss Channels in Acoustic Devices Using X-ray Photoelectron Spectroscopy and Atomic Force Microscopy.** *Microscopy and microanalysis : the official journal of Microscopy Society of America, Microbeam Analysis Society, Microscopical Society of Canada*
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- **Platform-agnostic waveguide integration of high-speed photodetectors with evaporated tellurium thin films** *OPTICA*
  Ahn, G., White, A. D., Kim, H., Higashitarumizu, N., Mayor, F. M., Herrmann, J. F., Jiang, W., Multani, K. K. S., Safavi-Naeini, A. H., Javey, A., Vuckovic, J.
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- **Bias-stable Sub-Volt Visible Electro-optic Modulator in Thin-Film Lithium Niobate**
  Celik, O., Ammar, N., Stokowski, H. S., Park, T., Safavi-Naeini, A., IEEE
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- **Tunable dual wavelength laser on thin film lithium niobate**
  Lufungula, I., Mayor, F. M., Herrmann, J. F., Park, T., Stokowski, H. S., Hwang, A. Y., De Beeck, C., Atalar, O., Jiang, W., Kuyken, B., Safavi-Naeini, A. H., IEEE
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- **Integrated passive nonlinear optical isolators** *NATURE PHOTONICS*
  White, A. D., Ahn, G., Gasse, K., Yang, K., Chang, L., Bowers, J. E., Vuckovic, J.
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- **Mirror symmetric on-chip frequency circulation of light** *NATURE PHOTONICS*
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- **Automated Discovery of Autonomous Quantum Error Correction Schemes** *PRX QUANTUM*
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- **Quantum state preparation and tomography of entangled mechanical resonators.** *Nature*
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- **Building a Fault-Tolerant Quantum Computer Using Concatenated Cat Codes** *PRX QUANTUM*
  Chamberland, C., Noh, K., Arrangoiz-Arriola, P., Campbell, E. T., Hann, C. T., Iverson, J., Putterman, H., Bohdanowicz, T. C., Flammia, S. T., Keller, A., Refael, G., Preskill, J., Jiang, et al
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- **2022 Roadmap on integrated quantum photonics** *JOURNAL OF PHYSICS-PHOTONICS*
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- **Superconducting on-chip tunable mm-wave resonator**
  Das, D., Naji, A., Multani, K. K. S., Safavi-Naeini, A. H., Nanni, E. A., IEEE
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- **III/V-on-lithium niobate amplifiers and lasers** *OPTICA*
  de Beeck, C., Mayor, F. M., Cuyvers, S., Poelman, S., Herrmann, J. F., Atalar, O., McKenna, T. P., Haq, B., Jiang, W., Witmer, J. D., Roelkens, G., Safavi-Naeini, A. H., Van Laer, et al
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- **Control Design for Inhomogeneous-Broadening Compensation in Single-Photon** *PHYSICAL REVIEW APPLIED*
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  2021; 8 (6): 921-924
- **Number Partitioning With Grover's Algorithm in Central Spin Systems** *PRX QUANTUM*
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- **Acousto-optic modulation of a wavelength-scale waveguide** *OPTICA*
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- **Loss channels affecting lithium niobate phononic crystal resonators at cryogenic temperature** *APPLIED PHYSICS LETTERS*
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  2021; 118 (12)
- **Development of Quantum Interconnects (QuICs) for Next-Generation Information Technologies** *PRX QUANTUM*
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- **Gigahertz Phononic Integrated Circuits on Thin-Film Lithium Niobate on Sapphire** *PHYSICAL REVIEW APPLIED*
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  McKenna, T. P., Stokowski, H. S., Ansari, V., Mishra, J., Jankowski, M., Sarabalis, C. J., Herrmann, J. F., Langrock, C., Fejer, M. M., Safavi-Naeini, A. H., IEEE
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  Mishra, S., Trivedi, R., Safavi-Naeini, A. H., Vuckovic, J., IEEE
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- **Integrated thin-film lithium niobate non-reciprocal circulator**
  Herrmann, J. F., Ansari, V., Wang, J., Witmer, J. D., Fan, S., Safavi-Naeini, A. H., IEEE
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