

Stanford



Amir Safavi-Naeini

Assistant Professor of Applied Physics

Bio

ACADEMIC APPOINTMENTS

- Assistant Professor, Applied Physics

PROFESSIONAL EDUCATION

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

PATENTS

- 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: <http://www.stanford.edu/~safavi/>

Teaching

COURSES

2018-19

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

2017-18

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

2016-17

- Atoms, Fields and Photons: APPPHYS 203 (Aut)
- Literature of Cavity QED and Cavity Optomechanics: APPPHYS 376 (Win)

2015-16

- Atoms, Fields and Photons: APPPHYS 203 (Aut)
- Introduction to Atomic Processes: APPPHYS 383 (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

David Ding

Postdoctoral Faculty Sponsor

Raphael Van Laer

Doctoral Dissertation Advisor (AC)

Patricio Arrangoiz-Arriola, Rishi Patel

Doctoral (Program)

Sze Cheung Lau

Publications

PUBLICATIONS

- **Controlling phonons and photons at the wavelength scale: integrated photonics meets integrated photonics (vol 6, pg 213, 2019) *OPTICA***
Safavi-Naeini, A. H., Van Thourhout, D., Baets, R., Van Laer, R.
2019; 6 (4): 410
- **Diamond optomechanical crystals with embedded nitrogen-vacancy centers *QUANTUM SCIENCE AND TECHNOLOGY***
Cady, J., Michel, O., Lee, K. W., Patel, R. N., Sarabalis, C. J., Safavi-Naeini, A. H., Jayich, A.
2019; 4 (2)
- **Time-of-flight imaging based on resonant photoelastic modulation *APPLIED OPTICS***
Atalar, O., Van Laer, R., Sarabalis, C. J., Safavi-Naeini, A. H., Arbabian, A.
2019; 58 (9): 2235–47
- **Controlling phonons and photons at the wavelength scale: integrated photonics meets integrated photonics *OPTICA***
Safavi-Naeini, A. H., Van Thourhout, D., Baets, R., Van Laer, R.
2019; 6 (2): 213–32
- **Superconducting circuit quantum computing with nanomechanical resonators as storage *QUANTUM SCIENCE AND TECHNOLOGY***
Pechal, M., Arrangoiz-Arriola, P., Safavi-Naeini, A. H.
2019; 4 (1)
- **Painting Nonclassical States of Spin or Motion with Shaped Single Photons *PHYSICAL REVIEW LETTERS***
Davis, E. J., Wang, Z., Safavi-Naeini, A. H., Schleier-Smith, M. H.
2018; 121 (12)
- **Cavity-Enhanced Raman Emission from a Single Color Center in a Solid. *Physical review letters***
Sun, S., Zhang, J. L., Fischer, K. A., Burek, M. J., Dory, C., Lagoudakis, K. G., Tzeng, Y., Radulaski, M., Kelaita, Y., Safavi-Naeini, A., Shen, Z., Melosh, N. A., Chu, et al
2018; 121 (8): 083601
- **Optomechanical antennas for on-chip beam-steering *OPTICS EXPRESS***
Sarabalis, C. J., Van Laer, R., Safavi-Naeini, A. H.
2018; 26 (17): 22075–99
- **Single-Mode Phononic Wire *PHYSICAL REVIEW LETTERS***
Patel, R. N., Wang, Z., Jiang, W., Sarabalis, C. J., Hill, J. T., Safavi-Naeini, A. H.
2018; 121 (4)
- **Coupling a Superconducting Quantum Circuit to a Phononic Crystal Defect Cavity *PHYSICAL REVIEW X***
Arrangoiz-Arriola, P., Wollack, E., Pechal, M., Witmer, J. D., Hill, J. T., Safavi-Naeini, A. H.
2018; 8 (3)
- **Single-Mode Phononic Wire. *Physical review letters***
Patel, R. N., Wang, Z., Jiang, W., Sarabalis, C. J., Hill, J. T., Safavi-Naeini, A. H.
2018; 121 (4): 040501

- **Painting Nonclassical States of Spin or Motion with Shaped Single Photons.** *Physical review letters*
Davis, E. J., Wang, Z., Safavi-Naeini, A. H., Schleier-Smith, M. H.
2018; 121 (12): 123602
- **Enhancing a slow and weak optomechanical nonlinearity with delayed quantum feedback** *NATURE COMMUNICATIONS*
Wang, Z., Safavi-Naeini, A. H.
2017; 8: 15886
- **High-Q photonic resonators and electro-optic coupling using silicon-on-lithium-niobate** *SCIENTIFIC REPORTS*
Witmer, J. D., Valery, J. A., Arrangoiz-Arriola, P., Sarabalis, C. J., Hill, J. T., Safavi-Naeini, A. H.
2017; 7
- **Thermal Brillouin noise observed in silicon optomechanical waveguide** *JOURNAL OF OPTICS*
Van Laer, R., Sarabalis, C. J., Baets, R., Van Thourhout, D., Safavi-Naeini, A. H.
2017; 19 (4)
- **Enabling Strong Coupling in Nanoscale Silicon Optomechanical Waveguides**
Van Laer, R., Safavi-Naeini, A., IEEE
IEEE.2017
- **Engineering interactions between superconducting qubits and phononic nanostructures** *PHYSICAL REVIEW A*
Arrangoiz-Arriola, P., Safavi-Naeini, A. H.
2016; 94 (6)
- **Design of nanobeam photonic crystal resonators for a silicon-on-lithium-niobate platform** *OPTICS EXPRESS*
Witmer, J. D., Hill, J. T., Safavi-Naeini, A. H.
2016; 24 (6): 5876-5885
- **Nonlinear Radiation Pressure Dynamics in an Optomechanical Crystal** *PHYSICAL REVIEW LETTERS*
Krause, A. G., Hill, J. T., Ludwig, M., Safavi-Naeini, A. H., Chan, J., Marquardt, F., Painter, O.
2015; 115 (23)
- **Phonon counting and intensity interferometry of a nanomechanical resonator** *NATURE*
Cohen, J. D., Meenehan, S. M., MacCabe, G. S., Groeblacher, S., Safavi-Naeini, A. H., Marsili, F., Shaw, M. D., Painter, O.
2015; 520 (7548): 522-525
- **Strong opto-electro-mechanical coupling in a silicon photonic crystal cavity** *OPTICS EXPRESS*
Pitanti, A., Fink, J. M., Safavi-Naeini, A. H., Hill, J. T., Lei, C. U., Tredicucci, A., Painter, O.
2015; 23 (3): 3196-3208
- **Silicon optomechanical crystal resonator at millikelvin temperatures** *PHYSICAL REVIEW A*
Meenehan, S. M., Cohen, J. D., Groeblacher, S., Hill, J. T., Safavi-Naeini, A. H., Aspelmeyer, M., Painter, O.
2014; 90 (1)
- **Two-Dimensional Phononic-Photonic Band Gap Optomechanical Crystal Cavity** *PHYSICAL REVIEW LETTERS*
Safavi-Naeini, A. H., Hill, J. T., Meenehan, S., Chan, J., Groeblacher, S., Painter, O.
2014; 112 (15)
- **Highly efficient coupling from an optical fiber to a nanoscale silicon optomechanical cavity** *APPLIED PHYSICS LETTERS*
Groeblacher, S., Hill, J. T., Safavi-Naeini, A. H., Chan, J., Painter, O.
2013; 103 (18)
- **Squeezed light from a silicon micromechanical resonator** *NATURE*
Safavi-Naeini, A. H., Groeblacher, S., Hill, J. T., Chan, J., Aspelmeyer, M., Painter, O.
2013; 500 (7461): 185-189
- **Laser noise in cavity-optomechanical cooling and thermometry** *NEW JOURNAL OF PHYSICS*
Safavi-Naeini, A. H., Chan, J., Hill, J. T., Groeblacher, S., Miao, H., Chen, Y., Aspelmeyer, M., Painter, O.
2013; 15

- **Si₃N₄ nanobeam optomechanical crystals** *2013 CONFERENCE ON LASERS AND ELECTRO-OPTICS (CLEO)*
Davanco, M., Chan, J., Safavi-Naeini, A. H., Painter, O., Srinivasan, K.
2013
- **Coherent optical wavelength conversion via cavity optomechanics** *NATURE COMMUNICATIONS*
Hill, J. T., Safavi-Naeini, A. H., Chan, J., Painter, O.
2012; 3
- **Slot-mode-coupled optomechanical crystals** *OPTICS EXPRESS*
Davanco, M., Chan, J., Safavi-Naeini, A. H., Painter, O., Srinivasan, K.
2012; 20 (22): 24394-24410
- **Quantum back-action in measurements of zero-point mechanical oscillations** *PHYSICAL REVIEW A*
Khalili, F. Y., Miao, H., Yang, H., Safavi-Naeini, A. H., Painter, O., Chen, Y.
2012; 86 (3)
- **Optimized optomechanical crystal cavity with acoustic radiation shield** *APPLIED PHYSICS LETTERS*
Chan, J., Safavi-Naeini, A. H., Hill, J. T., Meenehan, S., Painter, O.
2012; 101 (8)
- **Enhanced Quantum Nonlinearities in a Two-Mode Optomechanical System** *PHYSICAL REVIEW LETTERS*
Ludwig, M., Safavi-Naeini, A. H., Painter, O., Marquardt, F.
2012; 109 (6)
- **Observation of Quantum Motion of a Nanomechanical Resonator** *PHYSICAL REVIEW LETTERS*
Safavi-Naeini, A. H., Chan, J., Hill, J. T., Alegre, T. P., Krause, A., Painter, O.
2012; 108 (3)
- **A chip-scale integrated cavity-electro-optomechanics platform** *OPTICS EXPRESS*
Winger, M., Blasius, T. D., Alegre, T. P., Safavi-Naeini, A. H., Meenehan, S., Cohen, J., Stobbe, S., Painter, O.
2011; 19 (25): 24905-24921
- **Laser cooling of a nanomechanical oscillator into its quantum ground state.** *Nature*
Chan, J., Alegre, T. P., Safavi-Naeini, A. H., Hill, J. T., Krause, A., Gröblacher, S., Aspelmeyer, M., Painter, O.
2011; 478 (7367): 89-92
- **Laser cooling of a nanomechanical oscillator into its quantum ground state** *NATURE*
Chan, J., Mayer Alegre, T. P., Safavi-Naeini, A. H., Hill, J. T., Krause, A., Groeblacher, S., Aspelmeyer, M., Painter, O.
2011; 478 (7367): 89-92
- **Electromagnetically induced transparency and slow light with optomechanics** *NATURE*
Safavi-Naeini, A. H., Alegre, T. P., Chan, J., Eichenfield, M., Winger, M., Lin, Q., Hill, J. T., Chang, D. E., Painter, O.
2011; 472 (7341): 69-73
- **Quasi-two-dimensional optomechanical crystals with a complete phononic bandgap** *OPTICS EXPRESS*
Alegre, T. P., Safavi-Naeini, A., Winger, M., Painter, O.
2011; 19 (6): 5658-5669
- **Slowing and stopping light using an optomechanical crystal array** *NEW JOURNAL OF PHYSICS*
Chang, D. E., Safavi-Naeini, A. H., Hafezi, M., Painter, O.
2011; 13
- **Proposal for an optomechanical traveling wave phonon-photon translator** *NEW JOURNAL OF PHYSICS*
Safavi-Naeini, A. H., Painter, O.
2011; 13
- **Tunable 2D Photonic Crystal Cavities for Cavity Electro-Optomechanics** *2011 CONFERENCE ON LASERS AND ELECTRO-OPTICS (CLEO)*
Winger, M., Alegre, T. P., Safavi-Naeini, A. H., Painter, O.
2011

- **Full Phononic Bandgap in 2D-Optomechanical Crystals** *2011 CONFERENCE ON LASERS AND ELECTRO-OPTICS (CLEO)*
Alegre, T. P., Safavi-Naeini, A. H., Winger, M., Painter, O.
2011
- **Optomechanics in an ultrahigh-Q two-dimensional photonic crystal cavity** *APPLIED PHYSICS LETTERS*
Safavi-Naeini, A. H., Alegre, T. P., Winger, M., Painter, O.
2010; 97 (18)
- **Design of optomechanical cavities and waveguides on a simultaneous bandgap phononic-photonic crystal slab** *OPTICS EXPRESS*
Safavi-Naeini, A. H., Painter, O.
2010; 18 (14): 14926-14943
- **Optical Probing and Actuation of Microwave Frequency Phononic Crystal Resonators without Clamping Losses** *2010 CONFERENCE ON LASERS AND ELECTRO-OPTICS (CLEO) AND QUANTUM ELECTRONICS AND LASER SCIENCE CONFERENCE (QELS)*
Eichenfield, M., Chan, J., Safavi-Naeini, A. H., Painter, O. J.
2010
- **Slowing and stopping light with an optomechanical crystal array** *THIRD INTERNATIONAL WORKSHOP ON THEORETICAL AND COMPUTATIONAL NANOPHOTONICS - TACONA-PHOTONICS 2010*
Chang, D. E., Safavi-Naeini, A. H., Hafezi, M., Painter, O.
2010; 1291: 13-17
- **Efficient On-Chip Phonon-Photon Translation** *2010 CONFERENCE ON LASERS AND ELECTRO-OPTICS (CLEO) AND QUANTUM ELECTRONICS AND LASER SCIENCE CONFERENCE (QELS)*
Safavi-Naeini, A. H., Alegre, T. P., Painter, O. J.
2010
- **Surface-plasmon mode hybridization in subwavelength microdisk lasers** *APPLIED PHYSICS LETTERS*
Perahia, R., Alegre, T. P., Safavi-Naeini, A. H., Painter, O.
2009; 95 (20)
- **Modeling dispersive coupling and losses of localized optical and mechanical modes in optomechanical crystals** *OPTICS EXPRESS*
Eichenfield, M., Chan, J., Safavi-Naeini, A. H., Vahala, K. J., Painter, O.
2009; 17 (22): 20078-20098
- **Surface Plasmon Waveguide Mode Hybridization and Lasing in Sub-wavelength Microdisks at 1.3 μm** *2009 CONFERENCE ON LASERS AND ELECTRO-OPTICS AND QUANTUM ELECTRONICS AND LASER SCIENCE CONFERENCE (CLEO/QELS 2009), VOLS 1-5*
Perahia, R., Alegre, T. P., Safavi-Naeini, A., Painter, O.
2009: 3232-3233