Jacob Pettine

Postdoctoral Associate, MIT
Adjunct Assistant Professor, Stony Brook University
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EDUCATION & EXPERIENCE

Adjunct Assistant Professor | Stony Brook University — 2026–Present
Department of Physics and Astronomy

Postdoctoral Associate | Massachusetts Institute of Technology — 2024–Present
Department of Physics, Gedik Group

Director's Postdoctoral Fellow | Los Alamos National Laboratory — 2021–2024
CINT, Laboratory for Ultrafast Materials and Optical Sciences

Instructor | CU Boulder Physics Department — 2021
Upper Division Quantum Mechanics (co-Instructed with Prof. Charles Rogers)

NSF Graduate Research Fellow | CU Boulder/JILA — 2014–2020
Ph.D. in Physics, Nesbitt Group

- *Thesis:* Probing the femtosecond dynamics of hot electrons in metal nanoparticles via time- and angle-resolved photoemission spectroscopy

Undergraduate Research Assistant | CU Boulder/JILA — 2010–2013
B.S. in Engineering Physics

GRANTS & AWARDS

- Publication Prize in Experimental Science | LANL — 2025
- Lindau Nobel Laureate Meeting Fellowship | UC/LANL — 2024
- Exploratory Research Grant (Co-PI) | LANL LDRD — 2022
- Institute for Materials Science Grant (PI) | LANL LDRD — 2022
- Director's Postdoctoral Fellowship | LANL — 2021
- CU Physics Award for Postdoc Teaching Excellence | CU Boulder — 2021
- Beverly Sears Graduate Research Grant | CU Boulder — 2020
- APS Harry Lustig Award Finalist | APS 4CS — 2020
- GRC Poster Award | Noble Metals GRC — 2018

- NSF Graduate Research Fellowship | NSF 2015

PUBLICATIONS

$*\ corresponding,\ ^{\dagger}equal\ contribution$

Preprints

Reviews and perspectives

- J Pettine*, HT Chen*, "Making and Breaking Terahertz Waves with Fluids," *Photonics Insights* **2**, C05 (2023) [Commentary]
- J Pettine †, N Sirica †, P Padmanabhan †, AJ Taylor, RP Prasankumar, HT Chen*, "Ultrafast Terahertz Emission from Emerging Symmetry-Broken Materials," *Light: Sci. & Appl.* **12**, 133 (2023) [Review]
- J Pettine*, DJ Nesbitt*, "Emerging Methods for Controlling Excitation and Emission Distributions of Hot Carriers in Nanoplasmonic Systems," *J. Phys. Chem. C* **126**, 14767-14780 (2022) [Perspective]

Research articles

- A von Hoegen, T Tai, CJ Allington, M Yeung, J Pettine, M Michael, E Viñas Boström, X Cui, K Torres, AE Kossak, B Lee, GSD Beach, A Rubio, P Kim, N Gedik, "Visualizing a Terahertz Superfluid Plasmon in a Two-Dimensional Superconductor," *Nature* **650**, 869-874 (2026)
- J Pettine*, P Padmanabhan, T Shi, L Gingras, L McClintock, CC Chang, KWC Kwock, L Yuan, Y Huang, J Nogan, JK Baldwin, P Adel, R Holzwarth, AK Azad, F Ronning, AJ Taylor, RP Prasankumar, SZ Lin, HT Chen*, "Light-Driven Nanoscale Vectorial Currents," *Nature* **626**, 984 (2024)
- J Pettine*, P Maioli, F Vallee, N Del Fatti, DJ Nesbitt*, "Energy-Resolved Femtosecond Hot Electron Dynamics in Single Plasmonic Nanoparticles," *ACS Nano* **17**, 10721-10732 (2023)
- F Medeghini, J Pettine, SM Meyer, CJ Murphy, DJ Nesbitt*, "Regulating and Directionally Controlling Electron Emission from Gold Nanorods with Silica Coatings," *Nano Lett.* **22**, 644-651 (2022)
- J Pettine, SM Meyer, F Medeghini, CJ Murphy, DJ Nesbitt*, "Controlling the Spatial and Momentum Distributions of Plasmonic Carriers: Volume vs Surface Effects," *ACS Nano* **15**, 1566-1578 (2021)
- SM Meyer, J Pettine, DJ Nesbitt, CJ Murphy*, "Size Effects in Gold Nanorod Light-to-Heat Conversion under Femtosecond Illumination," *J. Phys. Chem. C* **125**, 16268-16278 (2021)
- J Pettine, P Choo, F Medeghini, TW Odom*, DJ Nesbitt*, "Plasmonic Nanostar Photocathodes for Optically-Controlled Directional Currents," *Nat. Commun.* **11**, 1367 (2020)
- J Pettine, M Zhu, DZ Anderson*, "Self-Adaptive Amplified Spontaneous Emission Suppression with a Photorefractive Two-Beam Coupling Filter," *Opt. Lett.* **45**, 6258-6261 (2020)
- J Pettine, A Marton Menendez, DJ Nesbitt*, "Continuous Angular Control over Anisotropic Photoemission from Isotropic Gold Nanoshells," *J. Chem. Phys.* **153**, 101101 (2020)
- J Pettine, A Grubisic, DJ Nesbitt*, "Polarization-Controlled Directional Multiphoton Photoemission from Hot Spots on Single Au Nanoshells," *J. Phys. Chem. C* **122**, 14805-14813 (2018)

- J Pettine, A Grubisic, DJ Nesbitt*, "Angle- and Momentum-Resolved Velocity Map Imaging Studies of Thin Au Film and Single Supported Au Nanoshells," *J. Phys. Chem.* C **122**, 3970-3984 (2018)

TALKS & POSTERS

09/2026 *Broken symmetries and tailored flows: Controlling electrical currents with light*, ACS Fall Meeting, Chicago, IL
(Invited Talk)

02/2026 *Designing Quantum Meta-Matter,* Condensed Matter Seminar, Stony Brook University, Stony Brook, NY
(Interview Talk)

07/2025 *Time-Resolved Terahertz Evidence for Unconventional Heavy Fermions in a Kagome Metal,* Conference on Strongly Correlated Electron Systems, Montreal, Canada
(Contributed Talk)

06/2025 *Tuning the Properties of Quantum Materials through Nanostructured Symmetries*, EPiQS Postdoctoral Symposium, Pasadena, CA
(Contributed Talk)

05/2025 *Bespoke Symmetries and Tailored Flows: Controlling Electrical Currents with Light*, Postdoctoral Prize in Experimental Science, Los Alamos National Laboratory, NM
(Awarded Talk)

04/2025 *Tuning the Properties of Quantum Materials through Nanostructured Symmetries*, Condensed Matter Physics Seminar, University of Connecticut, Storrs, CT
(Invited Talk)

11/2024 *Nanoscale Vectorial Photocurrents in Symmetry-Broken Metasurfaces,* FAU Chair of Laser Physics Autumn Retreat, Erlangen, Germany
(Invited Talk)

02/2024 *Light-Driven Currents in Emerging Materials,* Ultrafast Phenomena in Cooperative Systems, Lucca, Italy
(Poster)

10/2023 *Light-Based Nanoscale Current Control in Symmetry-Broken Optoelectronic Metasurfaces,* Frontiers in Optics + Laser Science, Tacoma, WA
(Invited Talk)

09/2023 *Vectorial Currents and Broadband Terahertz Vector Beams with Optoelectronic Metasurfaces*, IRMMW-THz, Montreal, Canada
(Invited Keynote Talk)

03/2023 *Ultrafast Vectorial Currents in Nanoscale Symmetry-Controlled Optoelectronic Metasurfaces,* APS March Meeting, Las Vegas, NV
(Contributed Talk)

10/2022 *Nanoscale Vectorial Current Control in Symmetry-Broken Optoelectronic Metasurfaces*, Ultrafast Phenomena in Cooperative Systems GRC, Ventura, CA
(Poster)

05/2022 *Ultrafast Nanoscale Photocurrent Control and Terahertz Emission in Hybrid Plasmonic-2D Material Systems*, CLEO (Virtual)
(Contributed Talk)

03/2022 *Bulk-Like Femtosecond Dynamics of Ballistic Hot Carriers in Single Plasmonic Gold Nanoparticles*, ACS Spring Meeting (Virtual)
(Contributed Talk)

03/2021 *Optically Controlling Femtosecond Hot Electron Spatial and Momentum Distributions in Nanoplasmonic Systems*, APS March Meeting (Virtual)
(Contributed Talk)

10/2020 *Optically Controlling Femtosecond Hot Electron Currents in Nanoplasmonic Systems*
APS 4CS Meeting, Harry Lustig Award Session (Virtual)
(Awarded Talk)

03/2020 *Plasmonic Nanostar Photocathodes for Optically-Controlled Directional Currents*, University of Colorado March Physics Symposium, Boulder, CO
(Contributed Talk)

10/2018 *Nanoplasmonics: Controlling Photons and Photocurrents at the Femto-Nanoscale*, Colorado Photonics Industry Association Meeting, Boulder, CO
(Poster)

07/2018 *Real Stories from Reciprocal Space: Angle-Resolved Photoemission Studies of Single Plasmonic Nanoparticles*, Noble Metals GRC, South Hadley, MA
(Awarded Talk)

07/2016 *Ultrafast Energy- and Angle-Resolved Photoemission Studies of Single Supported Plasmonic Nanoparticles*, Plasmonics and Nanophotonics GRC, Newry, ME
(Poster)

06/2014 *Coherent Multiphoton Photoelectron Emission from Individual Supported Au Nanorods: Angle- and Energy-Resolved Photoelectron Distribution Measurements via Velocity Map Imaging*, Excited State Processes, Santa Fe, NM
(Poster)

TEACHING & OUTREACH

- MIT UROP mentorship (2024-2026)
- High school science showcase (2025)
  - Science demonstrations at Cambridge Rindge and Latin school
- Teachers tour of Los Alamos Neutron Science facility (2023)
- Co-Instructor, CU Boulder PHYS-4410, Quantum Mechanics II (Spring 2021)
- CU Prime mentorship (2015-2016)
- Partnership for Informal Science Education in the Community (2014, 2015)
- CU Wizards (2016, 2018, 2020)
  - Assisted with community science presentations oriented toward young audience