



Emilio Alessandro Nanni

Assistant Professor of Photon Science and of Particle Physics and Astrophysics
Photon Science Directorate

Bio

BIO

Emilio received his B.S. in Electrical Engineering and Physics from Missouri University of Science and Technology in 2007. After graduating he worked for the NASA Marshall Space Flight Center developing non-destructive evaluation techniques for applications related to the US space program. He completed his PhD in Electrical Engineering from the Massachusetts Institute of Technology in 2013 where he worked on high-frequency high-power THz sources and the development of Nuclear Magnetic Resonance spectrometers using Dynamic Nuclear Polarization. His thesis was on the first photonic-band-gap gyrotron travelling wave amplifier which demonstrated record power and gain levels in the THz frequency band.

He completed his postdoc at MIT with a joint appointment in the Nuclear Reactor Lab and the Research Laboratory for Electronics at MIT where he demonstrated the first acceleration of electrons with optically generated THz pulses. He joined the Technology Innovation Directorate at SLAC in August of 2015 where he continues his work on high power, high-frequency vacuum electron devices; optical THz amplifiers; electron-beam dynamics; and advanced accelerator concepts.

ACADEMIC APPOINTMENTS

- Assistant Professor, Photon Science Directorate
- Assistant Professor, Particle Physics and Astrophysics

Teaching

COURSES

2022-23

- Mechanics: PHYSICS 41 (Aut)

2021-22

- Mechanics: PHYSICS 41 (Win)

2020-21

- Electricity and Magnetism: PHYSICS 43 (Sum)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Rachel Gruenke, Kevin Multani, Tony Zhang

Publications

PUBLICATIONS

- **Superconducting on-chip tunable mm-wave resonator**
Das, D., Naji, A., Multani, K. S., Safavi-Naeini, A. H., Nanni, E. A., IEEE
IEEE.2022
- **Cascaded particle accelerators reach new energy** *NATURE PHOTONICS*
Nanni, E. A.
2021
- **Spectrally reconfigurable quantum emitters enabled by optimized fast modulation** *NPJ QUANTUM INFORMATION*
Lukin, D. M., White, A. D., Trivedi, R., Guidry, M. A., Morioka, N., Babin, C., Soykal, O. O., Ul-Hassan, J., Son, N., Ohshima, T., Vasireddy, P. K., Nasr, M. H., Sun, et al
2020; 6 (1)
- **Experimental demonstration of externally driven millimeter-wave particle accelerator structure** *APPLIED PHYSICS LETTERS*
Othman, M. K., Picard, J., Schaub, S., Dolgashev, V. A., Lewis, S. M., Neilson, J., Haase, A., Jawa, S., Spataro, B., Temkin, R. J., Tantawi, S., Nanni, E. A.
2020; 117 (7)
- **Static and Dynamic Stark Tuning of the Silicon Vacancy in Silicon Carbide**
White, A. D., Lukin, D. M., Guidry, M. A., Trivedi, R., Morioka, N., Babin, C., Kaiser, F., Ul-Hassan, J., Son, N., Ohshima, T., Vasireddy, P., Nasr, M., Nanni, et al
IEEE.2020
- **Terahertz Dual-Fed Relativistic Electron Bunch Compression**
Othman, M. K., Gabriel, A. E., Snively, E. C., Kozina, M. E., Shen, X., Ji, F., Lewis, S., Vasireddv, P., Weathersby, S., Wang, X. J., Matthias, C., Hoffmann, Nanni, E. A., et al
IEEE.2020
- **Development of a Millimeter-Wave Transducer for Quantum Networks**
Multani, K. S., Stokowski, H., Snively, E., Patel, R., Jiang, W., Lee, N., Welander, P. B., Nanni, E. A., Safavi-Naeini, A. H., IEEE
IEEE.2020
- **High Gradient and of Breakdown Measurements in a Millimeter-Wave Accelerating Cavity**
Othman, M. K., Picard, J., Schaub, S., Dolgashev, V. A., Lewis, S., Spataro, B., Temkin, R. J., Tantawi, S., Nanni, E. A., IEEE
IEEE.2020
- **Ultrafast Dynamics of a Terahertz Dual-Fed Relativistic Electron Bunch Compressor**
Othman, M. K., Snively, E. C., Kozina, M. E., Kramer, P. L., Shen, X., Ji, F., Weathersby, S., Wang, X. J., Hoffmann, M. C., Nanni, E. A., IEEE
IEEE.2020
- **Parallel-plate waveguides for terahertz-driven MeV electron bunch compression** *OPTICS EXPRESS*
Othman, M. K., Hoffmann, M. C., Kozina, M. E., Wang, X. J., Li, R. K., Nanni, E. A.
2019; 27 (17): 23791–800
- **Terahertz-based subfemtosecond metrology of relativistic electron beams** *PHYSICAL REVIEW ACCELERATORS AND BEAMS*
Li, R. K., Hoffmann, M. C., Nanni, E. A., Glenzer, S. H., Kozina, M. E., Lindenberg, A. M., Ofori-Okai, B. K., Reid, A. H., Shen, X., Weathersby, S. P., Yang, J., Zajac, M., Wang, et al
2019; 22 (1)
- **Parallel-Plate THz Waveguides for Relativistic Electron Bunch Compression**
Othman, M. K., Hoffmann, M. C., Li, R., Nanni, E. A., Wang, X. J., IEEE
IEEE.2019
- **Nanomodulated electron beams via electron diffraction and emittance exchange for coherent x-ray generation** *PHYSICAL REVIEW ACCELERATORS AND BEAMS*
Nanni, E. A., Graves, W. S., Moncton, D. E.
2018; 21 (1)

- **Modeling of THz Pump Induced Plasmonic Oscillations in Silicon Membranes**
Wang, N., Nanni, E. A., Shen, X., Li, R. K., Hoffmann, M., Ofori-Okai, B. K., Zheng, Q., Yang, J., Wang, X. J., IEEE
IEEE.2018
- **Results from mm-Wave Accelerating Structure High-Gradient Tests**
Nanni, E. A., Dolgashev, V., Jawla, S., Neilson, J., Othman, M., Picard, J., Schaub, S., Spataro, B., Tantawi, S., Temkin, R. J., IEEE
IEEE.2018
- **Photonic-band-gap gyrotron amplifier with picosecond pulses** *APPLIED PHYSICS LETTERS*
Nanni, E. A., Jawla, S., Lewis, S. M., Shapiro, M. A., Temkin, R. J.
2017; 111 (23): 233504
- **Prototyping high-gradient mm-wave accelerating structures**
Nanni, E. A., Dolgashev, V. A., Haase, A., Neilson, J., Tantawi, S., Schaub, S. C., Temkin, R. J., Spataro, B., IOP
IOP PUBLISHING LTD.2017
- **Terahertz-driven, all-optical electron gun** *OPTICA*
Huang, W., Fallahi, A., Wu, X., Cankaya, H., Calendron, A., Ravi, K., Zhang, D., Nanni, E. A., Hong, K., Kaertner, F. X.
2016; 3 (11): 1209–12
- **Direct longitudinal laser acceleration of electrons in free space** *PHYSICAL REVIEW ACCELERATORS AND BEAMS*
Carbajo, S., Nanni, E. A., Wong, L., Moriena, G., Keathley, P. D., Laurent, G., Miller, R., Kaertner, F. X.
2016; 19 (2)
- **Terahertz-driven, sub-keV electron gun**
Huang, W., Fallahi, A., Wu, X., Nanni, E. A., Cankaya, H., Calendron, A., Zhang, D., Ravi, K., Hong, K., Kaertner, F. X., IEEE
IEEE.2016
- **Demonstration of an Ultracompact THz-driven Electron Gun**
Huang, W., Fallahi, A., Wu, X., Cankaya, H., Calendron, A., Ravi, K., Zhang, D., Nanni, E. A., Hong, K., Kaertner, F. X., IEEE
IEEE.2016
- **Amplification of Picosecond Pulses with a Photonic-Band-Gap Gyro-TWT**
Nanni, E. A., Jawla, S., Lewis, S. M., Shapiro, M., Temkin, R. J., IEEE
IEEE.2016
- **Toward a terahertz-driven electron gun** *SCIENTIFIC REPORTS*
Huang, W., Nanni, E. A., Ravi, K., Hong, K., Fallahi, A., Wong, L., Keathley, P. D., Zapata, L. E., Kaertner, F. X.
2015; 5: 14899
- **Terahertz-driven linear electron acceleration** *NATURE COMMUNICATIONS*
Nanni, E. A., Huang, W. R., Hong, K., Ravi, K., Fallahi, A., Moriena, G., Miller, R., Kaertner, F. X.
2015; 6: 8486
- **Theory of terahertz generation by optical rectification using tilted-pulse-fronts** *OPTICS EXPRESS*
Ravi, K., Huang, W., Carbajo, S., Nanni, E. A., Schimpf, D. N., Ippen, E. P., Kaertner, F. X.
2015; 23 (4): 5253–76
- **From incoherent to coherent x-rays with ICS sources**
Nanni, E. A., Graves, W. S., Moncton, D. E., Khounsary, A. M., MacDonald, C. A.
SPIE-INT SOC OPTICAL ENGINEERING.2015
- **Direct Machining of Low-Loss THz Waveguide Components With an RF Choke** *IEEE MICROWAVE AND WIRELESS COMPONENTS LETTERS*
Lewis, S. M., Nanni, E. A., Temkin, R. J.
2014; 24 (12): 842–44
- **The Fifteenth Special Issue on High-Power Microwave Generation** *IEEE TRANSACTIONS ON PLASMA SCIENCE*
Greenwood, A. D., Lehr, F., Nanni, E. A.
2014; 42 (6): 1481

- **Electron Acceleration in a Single-cycle Terahertz Field**
Huang, W., Nanni, E. A., Ravi, K., Wong, L., Hong, K., Kaertner, F. X., IEEE
IEEE.2014
- **Dynamic nuclear polarization at 700 MHz/460 GHz** *JOURNAL OF MAGNETIC RESONANCE*
Barnes, A. B., Markhasin, E., Daviso, E., Michaelis, V. K., Nanni, E. A., Jawla, S. K., Mena, E. L., DeRocher, R., Thakkar, A., Woskov, P. P., Herzfeld, J.,
Temkin, R. J., Griffin, et al
2012; 224: 1–7
- **A 250 GHz gyrotron with a 3 GHz tuning bandwidth for dynamic nuclear polarization** *JOURNAL OF MAGNETIC RESONANCE*
Barnes, A. B., Nanni, E. A., Herzfeld, J., Griffin, R. G., Temkin, R. J.
2012; 221: 147–53
- **Low-loss Transmission Lines for High-power Terahertz Radiation** *JOURNAL OF INFRARED MILLIMETER AND TERAHERTZ WAVES*
Nanni, E., Jawla, S., Shapiro, M. A., Woskov, P. P., Temkin, R. J.
2012; 33 (7): 695–714
- **Mode Content Determination of Terahertz Corrugated Waveguides Using Experimentally Measured Radiated Field Patterns** *IEEE TRANSACTIONS ON PLASMA SCIENCE*
Jawla, S. K., Nanni, E. A., Shapiro, M. A., Woskov, P. P., Temkin, R. J.
2012; 40 (6): 1530–37
- **THz Dynamic Nuclear Polarization NMR** *IEEE TRANSACTIONS ON TERAHERTZ SCIENCE AND TECHNOLOGY*
Nanni, E. A., Barnes, A. B., Griffin, R. G., Temkin, R. J.
2011; 1 (1): 145–63
- **Microwave field distribution in a magic angle spinning dynamic nuclear polarization NMR probe** *JOURNAL OF MAGNETIC RESONANCE*
Nanni, E. A., Barnes, A. B., Matsuki, Y., Woskov, P. P., Corzilius, B., Griffin, R. G., Temkin, R. J.
2011; 210 (1): 16–23
- **Recent Progress at MIT on THz Gyrotron Oscillators for DNP/NMR**
Temkin, R. J., Barnes, A. B., Griffin, R. G., Jawla, S., Mastovsky, I., Nanni, E. A., Shapiro, M. A., Torrezan, A. C., Woskov, P. P., Koch, M.
IEEE.2011
- **330 GHz Helically Corrugated Waveguide**
Woskov, P. P., Nanni, E. A., Shapiro, M. A., Jawla, S. K., Hummelt, J. S., Temkin, R. J., Barnes, A. B., Koch, M.
IEEE.2011
- **Design of a 527 GHz gyrotron for DNP-NMR spectroscopy**
Jawla, S., Nanni, E., Shapiro, M., Mastovsky, I., Guss, W., Temkin, R., Griffin, R., Koch, M.
IEEE.2011
- **Optimization of THz Wave Coupling into Samples in DNP/NMR Spectroscopy**
Nanni, E. A., Barnes, A. B., Matsuki, Y., Woskov, P. P., Corzilius, B., Griffin, R. G., Temkin, R. J., IEEE
IEEE.2010
- **Amplification of Picosecond Pulses in a 140 GHz Gyro-TWT**
Nanni, E. A., Kim, H. J., Shapiro, M. A., Woskov, P. P., Temkin, R. J., IEEE
IEEE.2010