Moussa N'Gom Ph. D.

Associate Professor
Physics, Applied Physics, & Astronomy
Rensselaer Polytechnic Institute
110 8th Street Troy, NY 12180

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Lab Website
(734) 478 – 6770

Education

May 2009: Ph.D. Applied Physics — Advisor: Theodore B. Norris
University of Michigan – Ann Arbor
Thesis: "Novel Approach to the Study of Surface Plasmon Resonance and Field Enhancement Properties of Noble Metal Nanostructures"

December 1999: B.S. Physics and Electrical Engineering,
University of Wisconsin – Milwaukee

Employment

Academic Appointments

Associate Professor of Physics

Department of Physics, Applied Physics, & Astronomy, Rensselaer Polytechnic Institute, July 2024 – Present

Scholar in Residence

IBM Quantum Center, Howard University, Spring and Summer 2025

Air Force Research Lab Summer Faculty Fellow

Department of Engineering Physics, Air Force Institute of Technology , Summer 2024

Assistant Professor of Physics

Department of Physics, Applied Physics, & Astronomy, Rensselaer Polytechnic Institute, Sept. 2018 – June 2024

Affiliate Faculty of Biophysics

Center for Biotechnology and Interdisciplinary Studies, Rensselaer Polytechnic Institute, 2018 – Present

Adjunct Research Scientist [0% effort.]

Electrical and Computer Engineering Division, University of Michigan, 2018 – Present

Assistant Research Scientist

Electrical and Computer Engineering Division, University of Michigan, 2015 – 2018

Professional Appointments

Senior Research Scientist — Corning Incorporated — Oct 2011 – Sept 2015
Research Staff Member — Institute for Defense Analyses — June 2009 – Oct 2011
Optical Measurement Engineer — Corning Incorporated — Jan 1999 – June 2002

Teaching Experience

Professor of Physics: Quantum Mechanics (Graduate Course), RPI, Fall 2025
Professor of Physics: Electrodynamics (Graduate Course), RPI, Spring 2020 – 2026
Professor of Physics: Introduction to Quantum Mechanics, RPI, Fall 2020 – 2024
Professor of Physics: Fundamental of Optics (Undergraduate Course), RPI, Spring 2018, 2019
Teaching Assistant: Ultrafast Optics (Graduate Course), University of MI, Winter 2008

Awards and honors

Rensselaer Board of Trustees Faculty Achievement Award (2024)
School of Science – Outstanding Faculty Research Award (2024)
Rensselaer Board of Trustees Faculty Achievement Award (2023)
Rensselaer Alumni Association (RAA) and Board of Trustees Teaching Award (2023)
School of Science – Outstanding Teaching Award (2023)
NextProf Alumnus (2016)
Corning Incorporated: Safe Haven Award ($50,000): "Mode Division Multiplexing in Few Mode Fibers", 2015.
JASON Intern (Summer 2010; Study Leader: Professor Robert D. Grober – Yale University)
Horace G. Rackham Merit Fellowship, University of Michigan
Wisconsin Space Grant Consortium recipient, UW-Milwaukee
Tau Beta Pi honor society

Funding Sources

Active

`Project/Proposal Title:` "Consortium for Enabling Technologies & Innovation (ETI) 2.0"
PI: Anna S. Erickson (Georgia Institute of Technology); Co-PI: M. N'Gom,
`Source of Support:` National Nuclear Security Agency
`Total Award Amount:` $50.0M; RPI's portion $ 950,000
`Start/End Date:` 03/14/2025 – 03/13/2030

`Project/Proposal Title:` Diabetic wound healing interrogation with quantum light and wavefront shaping
`Source of Support:` The Moore Foundation
`Total Award Amount:` $325,000

Start/End Date: Sept. 2023 to Aug. 2026

Project/Proposal Title: On the Development of Free Space Optical Communications Terminals (OCT)
Source of Support: Air Force Research Lab (AFRL) – AFWERX
Total Award Amount: $ 250,000
Start/End Date: March. 2024 to Aug. 2025

Project/Proposal Title: Reaching an Advanced Computing Technologies Workforce through Education Initiatives in Quantum Information Science and Engineering (ReACT-QISE)
Source of Support: Department of Energy – Advanced Computing Technologies
Total Award Amount:$5.0M; RPI's portion $ 450,000
Start/End Date: Sept. 2023 to Aug. 2026

Project/Proposal Title: Topological Vortex Structure and Piezoelectric Enhancements in Low Dimensional Ferroelectrics
Source of Support: Department of Defense (Air Force Research Laboratory)
Award Number: HM0 23-0213
Total Award Amount: $250,000
Start/End Date: Sept. 2023 to Aug. 2025

Project/Proposal Title: Free Space Optical Communication Through Dynamic Media
Source of Support: National Geospatial Intelligence Agency
Award Number: HM0476-20-1-0012
Total Award Amount: $475,000
Start/End Date: Sept. 2020 to Aug. 2024

Publications

Peer Reviewed

"*Enhancement of Second Harmonic Generation in Monolayer WS_2 by Feedback-Based Wavefront Shaping*"
R. Berger, A. Mavian, E. Dimitrov, , N. Zhang, N. Rumman, P. Bassène, H. Terrones, E. A. Wertz, M.Terrones, , E. Fohtung, & M.N'Gom
Optica Phot. Res., Vol. 13 No. 11 (2025).

"*Mitosis-like dynamic for conservation of OAM*"
V. Tran, T. Wang, P. Bassène, F. Buldt, T. A. Searles, E. Fohtung, C. T. Law, & Moussa N'Gom
Nat. Sci. Rep. vol. 15, No. 25780 (2025).

"*Optimizing Fluorescence Imaging Through Scattering Media Using Structured Light-Assisted Wavefront Shaping*"
N. Rumman, P. Bassène, T. Wang, A. Mavian, E. Fohtung, A. Dixon, T. A. Searles, & M. N'Gom
Cell Rep. iScience 28, No.113429, (2025).

"*Manipulating Ferroelectric Topological Polar Structures with Twisted Light*"
N. P. Nazirkar, V.Tran, P. Bassène, A. Ndiaye, J. Barringer, R. Harder, Moussa N'Gom, & E. Fohtung
Adv. Mater., 2415231 (2025).

"*Real-Time Tracking of Nanoscale Morphology and Strain Evolution in Bi_2WO_6 via Operando Coherent X-Ray Imaging*"
J. Anderson, N. P. Nazirkar, A. Ndiaye, J. Barringer, V. Tran, P. Bassène, R. Harder, M. N'Gom, & E. Fohtung
Adv. Mater., 2504445 (2025).

"*Classification of single photons in higher-order spatial modes via convolutional neural networks*",
M. P. Bart, S. Dawanse, N. J. Savino, V.Tran, T. Wang, S. Lohani, F. Nefissi, P. Bassène, M. N'Gom, & R. T. Glasser
Optics Letters, Vol. 50, No. 9, (2025)

"*Second harmonic Bessel-Gauss beam shaping with elliptic axicon aberrations*"
T. Wang, F. Buldt, P. Bassène, S. Reza , T. A. Searles , C. Tai Law, E. Fohtung, and M. N'Gom,
Phys. Rev. Res., 7, 013012 (2025)

"*Coherent Diffractive Imaging with Twisted X-rays: Principles, Applications and Outlook*",
N. P. Nazirkar, X. Shi, J. Shi, M. N'Gom, and E. Fohtung
Invited Review: App. Phys. Rev., Vol. 11, No. 2 (2024)

"*Introduction to the Special Feature: Amplify Black Voices in Optics and Photonics*",
K. C. Toussaint, A. K. Bowden, A. Ndao, M. N'Gom, and T. A. Searles
Multi-journal Feature Issue, Opt. Express 32(6), 9213-9218 (2024).

"*Adaptive Methods of Generating Complex Light Arrays*",
T. Wang, V. Tran, P. Bassène, E. Fohtung, & M. N'Gom
Journal of the Optical Society of America A, Vol. 41, No. 1 (2024)

"*On the Exploration of Structured Light Transmission Through a Multimode Fiber in a Reference-less System*",
V. Tran, T. Wang, N. P. Nazirkar, P. Bassène, E. Fohtung, & M. N'Gom
APL Photonics 8, 126111 (2023)

"*ManQala: Game-Inspired Strategies for Quantum State Engineering*",
O. Danaci, W. Zhang, R. Coleman, W. Djakam, M. Amoo, R. T. Glasser, B. T. Kirby, M. N'Gom, T. A. Searles
Editor's Pick: Journal Cover; AVS Quantum Sci. 5, 032002 (2023).

"*Scoring based genetic algorithm for wavefront shaping to optimize multiple objectives*",
T. Wang, N. Rumman, P. Bassène, & M. N'Gom
Invited Article: MDPI – J. Imaging, 9, 49, (2023).

"*Information transmission through clouds using structured light beams*",
T. Wang, S. B. A. Reza, F. Buldt, P. Bassène, & M. N'Gom
Editor's Pick: Journal Cover; Journal of Applied Physics 133, 043102 (2023)

"*Generation of Multiple Obstruction-Free Channels for Free Space Optical Communication*",
S. B. A. Reza, M. Burger, P. Bassène, T. Nutting, I. Jovanovic, & M. N'Gom
Opt. Exp. Vol. 31, Issue 2, pp. 3168-3178 (2023)

"*Multiple feedback based wavefront shaping method to retrieve hidden signal*",
N. Rumman, T. Wang, K. Jennings, P. Bassène, F. Buldt, M. N'Gom
Featured: Advances in Optical Microscopy for Bioimaging
Appl. Phys. Lett. 121, 063701 (2022)

"*Polarimetric coherent diffraction imaging on cancer-associated fibroblast & SARS CoV-2 Viruses*",
X.Shi, D. Karpov, Z. Barringer, E. Schold, D. Sarr, M. N'Gom, J. Kelber, & Fohtung,
Research Square, 4, (2021).

"*Multi-Qubit Production in Spontaneous Parametric Down Conversion*",
P. Heitert, F. Buldt, P. Bassène, M. N'Gom
Phys. Rev. Applied Vol. 16, No. 6, 064048 (2021)

"*Mode Control in a Multimode Fiber Through Acquiring its Transmission Matrix from a Reference-less Optical System*",
M. N'Gom, T. B. Norris, E. Michielssen, and R. R. Nadakuditi
Optics Letters, Vol. 43, No. 3, 419 (2018)

"*Controlling Light Transmission Through Highly Scattering Media Using Semi-Definite Programming as a Phase Retrieval Computation Method*",
M. N'Gom, M. B. Lien, N. M. Estakhri, T. B. Norris, E. Michielssen, and R. R. Nadakuditi
Nat. Sci. Rep. Vol. 7, No. 1, 2518 (2017)

"*Plasmon Loss Spectroscopy of Au/ZnO Nanoparticles: Prospects for Ultrafast Dynamics in Hybrid Nanostructures*"
T. Norris, N. J. Zaluzec, J. F. Mansfield, M. Yang, N. Kotov, M. N'Gom, E. Olsson
Microsc. Microanal. 16 (Suppl 2), (2010)

"*Electron Beam Mapping of Plasmon Resonances of Electromagnetically Coupled Gold Nanorods*",
M. N'Gom, S. Li, G. Schatz, R. Erni, A. Agarwal, N. Kotov and T. Norris
Physical Review B 80, 113411 (2009)

"*Exploring the Emerging Frontier at the Intersection of Optics and Electron Microscopy*",
M. N'Gom and T. B. Norris,
invited article: S & T, SPIE Newsroom 10.1117/2.1200901.1493

"*Single Particle Plasmon Spectroscopy of Silver Nanowires and Gold Nanorods*",
M. N'Gom, J.Ringnalda, J. F. Mansfield, A. Agarwal, J. Ye, N. Kotov, N. J. Zaluzec, T. B. Norris.
Nanoletters vol. 8, No. 10, 2008, 3200 – 3204 (2008)

"*Relation Between Quantum Tunneling Times for Relativistic Particles*",
H. G. Winful, M Ngom, N. Litchinitser,
Phys. Rev. A 70, 052112 (2004)

"*Parameterization of Inclusive Cross Sections from Pion production in Proton-Proton collision*",
S. R. Blattnig, S. R. Swaminathan, A. T. Kruger, M. Ngom, and J. W. Norbury
Physical Review D. vol 62, pg 094030 (2000)

Conference Proceedings & Publications

"*A Hybrid Quantum Probe for Enhanced Remote Spectroscopy*",
Invited Oral Presentation
Optica Sensing Congress, QW1B.1 (2025).

"*Exploring non-equilibrium ferroelectric phases via twisted light–matter interaction*",
Oral Presentation
SPIE – Spintronics XVIII, Vol. 13586, (2025).

"*Manipulating Incident Light to Create Complex States and Control Spatial Correlations in SPDC*",
Oral Presentation
Frontiers in Optics + Laser Science: FiO, LS, JW4A. 28, (2024)

"*Line Focus Generation via a Scattering Medium*",
Oral Presentation
Frontiers in Optics + Laser Science FiO, LS, JW5A.38 (2024).

"*Operando Imaging of Strain and Defects at the Nanoscale*",
Oral Presentation
IEEE 24th International Conference on Nanotechnology (NANO), 483-488
DOI: 10.1109/NANO61778.2024.10628841 (2024).

"*A Wavefront Shaping Approach to Second Harmonic Generation Enhancement in WS_2*",
Oral Presentation
Frontiers in Optics + Laser Science FiO, LS, FTh3E.2 (2024).

"*Generation of Multiple Obstruction – (SF1R.4)*",
Oral Presentation; Control Number: 3855849
CLEO: Conference on Lasers and Electro-Optics, Optica 2023.

"*Transmission Matrix retrieval through multimode fiber in a reference-less optical system (SM3L.2)*",
Oral Presentation; Control Number: 3856651
CLEO: Conference on Lasers and Electro-Optics, Optica 2023.

"*Generating Knotted and Linked Gaussian Dots from Bessel-Beams (FF2B.3)*",
Oral Presentation; Control Number: 3855761
CLEO: Conference on Lasers and Electro-Optics, Optica 2023.

"*Simultaneous Optimization of Multiple Hidden Fluorescent Targets with Wavefront Shaping (ATu4Q.2)*",
Oral Presentation; Control Number: 3854050
CLEO: Conference on Lasers and Electro-Optics, Optica 2023.

"*Re-tooling Non-Linear Optical Interactions with Structured Light*",
Keynote Panel Speaker
11^{th} International Conference of African Materials Society, Dakar, Senegal,
December 12th – 15th, 2022.

"*On the Generation of Topological Optical Solitons*",
Invited Oral Presentation; Control Number: 3730543
Advanced Photonics Congress, Optica 2022.

"*Retrieving Masked Signal Through Tracking and Wavefront*",
Oral Presentation; Control Number: 3696052
CLEO: Conference on Lasers and Electro-Optics, Optica 2022.

"*Femtosecond Filament Coupled with Structured Light for Free Space Optical Communication*",
Poster; Joint Poster Session III
CLEO: Conference on Lasers and Electro-Optics, Optica 2022.

"*Quantum State Engineering with a Mancala Game on a Real Quantum Board*",
Oral Presentation; Abstract: Y38.00011
Bulletin of the American Physical Society, 2022 - APS.

"*On the Generation of Topological Optical Solitons*",
Oral Presentation; Abstract: S34.00009
Bulletin of the American Physical Society, 2022 - APS.

"*Nonlinear Conversion of Orbital Angular Momentum States of light*",
Oral Presentation; JTh5A. 85
Frontiers in Optics + Laser Science Conference (FiO LS) 2021.

"*Multi-qubit production in spontaneous parametric down conversion*",
Oral Presentation; FW1E. 4
Frontiers in Optics + Laser Science Conference (FiO LS) 2021.

"*Re-tooling Optical Methods with Structured Light*",
Invited Oral Presentation;
Corning Incorporated Fall Scientific Lecture Series, (2021).

"*Wavefront Shaping: A New Tool in Optics*",
Invited Oral Presentation: Abstract Number: 152, Program Number: C3+C2+C1-ThM5
International Conference onMetallurgical Coatings and Thin Films (ICMCTF) 2019.

"*Non-Holographic Method to Compute the Transmission Matrix of a Multimode Fiber for Mode Control*",
Oral Presentation: Postdeadline Papers I (FTh4A)
Frontiers in Optics (OSA) 2017; Postdeadline Papers: FTh4A.

"*Wavefront Shaping Through Scattering Media Using Semi-Definite Programming as a Phase Retrieval Computation Method*",
Oral Presentation: Mathematics in Imaging
Imaging and Applied Optics Conference (OSA) 2017 paper: MTu2C. 2.

"*Plasmon Resonance Variation from Strongly Interacting Gold Nanorods*",
Oral Presentation CLEO/QELS 2009 conference.
International Quantum Electronics Conference (IQEC) 2009 paper: JWE4

"*Enhanced Surface Third Harmonic Generation from Gold Nanorods*",
Oral Presentation CLEO/QELS 2009 conference.
International Quantum Electronics Conference (IQEC) 2009 paper: IMK4.

"*Correlation Spectroscopy of Third-Harmonic Generation by Single Nanorods*",
Conference on Lasers and Electro-Optics (CLEO) 2009 paper: CThK3.

"*Single Particle Plasmon Spectroscopy of Silver Nanostructures*",
Oral Presentation CLEO/QELS 2008 conference.
Quantum Electronics and Laser Science Conference (QELS) 2008 paper: QFK4.

"*Electron Energy Loss Spectroscopy of Individual Noble Metal Nanostructures*",
Oral Presentation OSA/Plamonics/Metamaterials 2008 conference.
Plasmonics and Metamaterials (META_PLAS) 2008 paper: MMC2.

Patents

- Application#18/582,176 (RPI docket no. 2023-050)
  Title: `Systems and Methods and for Free -- Space Optical Communication`
- Application#: WO 2017/027784 A1 [Granted]
  Title: `Methods and Systems for Printing 3D Objects`
- Application#: 62/072,682 (Corning docket no. SP14-325) [Granted]
  Title: `Edge Sealing of Laminate Glass Using Laser Glass Welder`
- Application#: US 14/993,236 (U.S. Attorney Docket No.: SP14-311) [Granted]
  Title: `Laser Cutting of Thermally Tempered Substrate`
- Application# 61/917,092 (U.S. Attorney Docket No.: SP16-236) [Granted]
  Title: `Electrochromic Coated Glass Articles and Methods for Laser Processing The Same.`
- Application#: 62/137,443 (U.S. Attorney Docket No.: SP15-107) [Granted]
  Title: `Laser Cutting and Processing of Display Glass Composition`

Service and Community Outreach

Students Supervised

Current Postdoc: Pascal Bassène

Graduate Students:

Current:

PhD Students: Russell Berger, Viet Tran, Tianhong Wang, Joseph Daafour, Saad Bin Ali Reza, Kwakye Kendja, Punom Roy

Graduated:

*MS Students:*Taylor Jurgensen, Ameerah Jabr-Hamdan, Tianhong Wang

PhD Students: Finn O. Buldt: "Pushing the Boundaries of Nonlinearities Using Structured Light"

PhD Students: Nazifa Rumman: "On The Development of Non-Invasive Diagnosis Tools with Optical Wavefront Shaping"

Undergraduate Students:

Current: Angelina Dobal, Claudio Giavalisco, Skyler Bell, Jacob Merida, Asterix Lombardo, Yue Zhu, William Krause, Arthur Kardoc

Former: Alex Mavian (Yale University – 2025), Kaitlin Jennings (University of Pennsylvania – 2024), Sam Goodwin (Industry 2019), Spencer Dimitroff (PhD Student – U. of New Mexico 2019), Angela Mehta (PhD Student – Princeton 2021); Aaron Pearra (PhD Student – Penn State 2021)

Dissertation Committee

- Julie Barringer. "Characterization of Crystal Defects Using Coherent X-ray Methods", Department of Material Science and Engineering Rensselaer Polytechnic Institute, Nov. 2024 (Advisor: Edwin Fohtung)
- John Rollinson, "Monolithic Electronic-Photonic Integrated Circuits for Free-Space Sensors and Receivers", Department of Electrical, Computer, and Systems Engineering, Rensselaer Polytechnic Institute, April 2024 (Advisor: Mona M. Hella,)
- Zachary Hallenbeck, "Super-Resolution Lifetime Imaging of Single Molecules Surrounding Gold Bowtie Nanoparticles", Department of Physics, Applied Physics, and Astronomy, Rensselaer Polytechnic Institute, May 2022 (Advisor: Esther Wertz)
- Alexander Kaiser, "Design and Fabrication of Teepee Photonic Crystal for High-Efficiency thin film Solar Cell Architectures" Department of Physics, Applied Physics and Astronomy. Rensselaer Polytechnic Institute, Dec. 2022 (Advisor: Shawn–Yu Lin)
- Nathan Kimmitt, "Using Super-Resolution Imaging to Investigate the Coupling Dynamics of Single Emitters to Plasmonic Nanoantennas", Department of Physics, Applied Physics and Astronomy. Rensselaer Polytechnic Institute November 5, 2020, (Advisor: Esther Wertz)
- Brandon D. Lucas, "Nano–imprint Lithography and its Applications in Photonics, Biotechnology and Energy Conversion Devices", Department of Physics: Applied Physics Program, University of Michigan, May 20, 2016, (Advisor: Longjie Guo)

University Committees

Department:
Graduate Recruiting Committee (09/2018 – Present)
Physics Department Executive Committee (01/20 – Present)
APS Bridge program point of contact, Physics Department. (09/2018 – Present)
School of Science:
Review Committee for the Dean of Science, 2021
Dean's Covid task force, School of Science (04/2020 – 09/2020)
University
Search committee for University Provost, 2023
Search committee for University President, 2021
Faculty senator for the School of Science 2019 – Present

Proposal Reviewer

DoD: ARL, AFRL (2023 - present)
NSF (2018 – Present)
NGA (2020 – Present)

Journal Reviewer

Nanoletters, Applied Physics Letters, Optics Letters, Optics Express, Phys. Rev. Applied, Phys. Rev. Research, Physics. Rev. Letters, Science.
Optica Publishing Group – **Guest Editor:** Optics Express, Biomedical Optics Express

Professional Affiliations

National Society of Black Engineers
National Society of Black Physicists.
Optical Society of America Member
American Physical Society Member
AAAS Member

Languages

Ouoloff: Mothertongue
English: Fluent
French: Native