Edward B. Flagg – Curriculum Vitae

Department of Physics and Astronomy
West Virginia University
White Hall
Morgantown, WV 26506-6315
edward.flagg@mail.wvu.edu
+1 304-293-7411
http://edwardflagg.faculty.wvu.edu

last updated: 2023-12-13

Current Appointment

Associate Professor of Physics, *West Virginia University* 2019 – present

Education

Ph.D. (Physics) University of Texas at Austin (2008)
Dissertation: *Coherent control and decoherence of single semiconductor quantum dots in a microcavity.*
Adviser: Chih-Kang (Ken) Shih

B.S. (Physics) Massachusetts Institute of Technology (2001)

Previous Appointments

Assistant Professor of Physics, *West Virginia University*	2013 – 2019
Research Associate, *National Institute of Standards and Technology*	2008 – 2012
Post-doctoral Researcher, *Joint Quantum Institute, University of Maryland*	2008 – 2012
Research Assistant, *University of Texas at Austin*	2002 – 2008
Teaching Assistant, *University of Texas at Austin*	2001 – 2002

Honors

WVU Foundation Outstanding Teacher Award (University-wide award)	2017 – 2018
Eberly College of Arts and Sciences Outstanding Teacher Award	2017 – 2018
Cottrell Scholars Award from Research Corp. for Science Advancement	2017
NSF CAREER Award	2015

Research

West Virginia University

- Microphotoluminescence studies of semiconductor nanostructures
- Quantum photonic device design and fabrication
- Optically controlled electron spin resonance and measurement
- Nonlinear and quantum optical experiments

Joint Quantum Institute, NIST and University of Maryland

- Measurements of photon indistinguishability
- Semiconductor-based single-photon & entangled-photon sources
- Cavity quantum electrodynamics
- Hybrid quantum information systems

University of Texas at Austin

- Quantum optics and cavity quantum electrodynamics involving semiconductor quantum dots in microcavities.

- Achieved the first observation of resonance fluorescence in a solid-state system.
- Patented a novel method for quickly and accurately determining the absolute value of the optical path length of a structure.
- Worked on the development of a method for mechanical slowing of a monochromatic supersonic atomic beam.

Massachusetts Institute of Technology

- Designed and constructed a high-Q spherical-mirror Fabry-Perot cavity for optical trapping of single atoms for use in quantum teleportation.

Research Grants Received

1. "Fabrication of Inversely Designed Nanophotonic Structures for Quantum Emitters." (PI), NSF EPSCoR RII Track-4: EPSCoR Research Fellows program, 2327223.
   Feb 1, 2024 – Jan 31, 2026
   Amount to WVU: $276,075 (100%)
2. "Advancing fabrication of inversely designed quantum nanophotonic devices." (PI), NIST Measurement Science and Engineering program, 70NANB23H257.
   Sep 1, 2023 – Aug 31, 2026
   Amount to WVU: $249,549 (100%)
3. "Entanglement-enhanced multiphoton fluorescence imaging of in vivo neural function." (PI: Flagg; Co-PIs: A. Bristow, K. Daly, C. Anderson), NSF Quantum Sensing Challenges for Transformational Advances in Quantum Systems (NSF press release), 2326758.
   Sep 1, 2023 – Aug 31, 2027
   Amount to WVU: $2,000,000 (100%) Amount to Flagg: $567,914 (28%)
4. "SUPER-PICs: Swing-UP of quantum emittER single-photon sources in Photonic Integrated Circuits." (PI), ONR Quantum Information Science Program, N00014-23-1-2611.
   July 1, 2023 – June 30, 2026
   Amount to WVU: $619,017 (100%)
5. Cottrell Scholars Award (PI), Research Corporation for Scientific Advancement.
   July 1, 2017 – June 30, 2020
   Amount to WVU: $100,000 (100%)
6. "Combined Coherent Manipulation and Single-Shot Measurement of an Electron Spin in a Quantum Dot" (PI), DOE-BES Physical Behavior of Materials Program, DE-SC0016848.
   December 15, 2016 – December 14, 2021
   Amount to WVU: $476,964 (100%)
7. "LIFIoVFO Laser Induced Fluorescence Imaging of Variable Flow Olfactometer Output," (co-PIs: E. Scime, K. Daly) Centers for Neuroscience, West Virginia University.
   June 1, 2016 – January 31, 2017
   Amount to WVU: $53,082 (100%)
8. "CAREER Coherent Single-Photons for Quantum Information" (PI), National Science Foundation, DMR-1452840.
   March 1, 2015 – February 28, 2022
   Amount to WVU: $700,000 (100%)
9. "Quantum Eraser: Entangled Photon Source" (PI: E.B. Flagg; co-PIs: S. Polyakov, T. Thomay) Joint Quantum Institute, NSF Physics Frontier Center Seed Grant.
   February 1, 2012 – January 31, 2013
   Amount to NIST: $50,000 (100%)

Teaching Experience

2018 Outstanding Teacher Award, Eberly College and WVU Foundation

2013-pres. **Associate/Assistant Professor**, West Virginia University
Introduction to Modern Physics, PHYS 314 (2013 – 2015)
Introductory Quantum Mechanics, PHYS 451 (2015 – 2019)
Quantum Mechanics 2, PHYS 452 (2016 – 2020, 2023)
Nonlinear Dynamics, PHYS 710 (2019 – 2021)
Atomic Physics, PHYS 325 (2021) Classical Mechanics 2, PHYS 332 (2022)
Oscillations and Thermal Physics, PHYS 312 (2022 – present)

2003-2005 **Physics Tutor**, University of Texas at Austin
Tutored individual students in undergraduate-level physics courses.

2000-2001 **Head teaching assistant**, University of Texas at Austin
Taught classical mechanics laboratory for natural sciences undergraduates.
Trained and supervised 3 other teaching assistants and over 150 students.

Professional Memberships

American Physical Society, since 2007
Optical Society of America, since 2013

Publications and Patents (reverse chronological)

1. Melo EG, Eshbaugh W, Flagg EB, Davanco M. "Inverse design of a polarization demultiplexer for on-chip path-entangled photon-pair sources based on single quantum dots." *Optics Letters*, 48(17), 4516–4519 (2023). doi:10.1364/OL.496129
2. Melo EG, Eshbaugh W, Flagg EB, Davanco M. "Multiobjective Inverse Design of Solid-State Quantum Emitter Single-Photon Sources." *ACS Photonics*, 10(4), 959-967 (2022). doi:10.1021/acsphotonics.2c00929
3. Wilkinson, T.A., Maurer, C.E., Flood, C.J., Lander, G., Chafin, S., Flagg, E.B. "Complete Stokes vector analysis with a compact, portable rotating waveplate polarimeter." *Review of Scientific Instruments*, 92(9):093101 (2021). doi:10.1063/5.0052835
4. Solomon, G.S., Muller, A., and Flagg, E.B. "Quantum light from optically dressed quantum dot states in microcavities." In S. T. Cundiff and M. Kira, editors, *Semiconductor Quantum Science and Technology*, volume 105 of *Semiconductors and Semimetals*, pages 305 – 346. Elsevier, Nov 2020.
5. Wilkinson T.A., Cottrill D.J., Cramlet J.M., Maurer C.E., Flood C.J., Bracker A.S., Yakes M., Gammon D., Flagg E.B. "Dynamic nuclear polarization in a charged quantum dot induced by the AC Stark effect." *Quantum Nanophotonic Materials, Devices, and Systems 2019*, 11091:110910I (2019). doi:10.1117/12.2529455
6. Lander G.R., Isaac S., Chen D., Demircan S., Solomon G.S., Flagg E.B. "Auger recombination-induced neutralization and stretched exponential recharging in an InAs quantum dot." *Quantum Dots and Nanostructures: Growth, Characterization, and Modeling XVI*, 10929:109290F (2019). doi:10.1117/12.2506555
7. Wilkinson T.A., Cottrill D.J., Cramlet J.M., Maurer C.E., Flood C.J., Bracker A.S., Yakes M., Gammon D., Flagg E.B. "Spin-selective AC Stark shifts in a charged quantum dot." *Applied Physics Letters*, 114(13):133104 (2019). doi:10.1063/1.5084244

8. Gazzano, O., Huber, T., Loo, V., Polyakov, S., Flagg, E. B., and Solomon, G. S. “Effects of Resonant-Laser Excitation on the Emission Properties in a Single Quantum Dot” *Optica* 5, no. 4 (2018): 354–359. doi:10.1364/OPTICA.5.000354
9. Chen, D., Lander, G. R., Flagg, E. B. “Resonance Fluorescence of an InGaAs Quantum Dot in a Planar Cavity using Orthogonal Excitation and Detection” *Journal of Visualized Experiments* 128, (2017): e56435. doi:10.3791/56435
10. Chen, D., Lander, G. R., Solomon, G. S., and Flagg, E. B. “Polarization-Dependent Interference of Coherent Scattering from Orthogonal Dipole Moments of a Resonantly Excited Quantum Dot” *Physical Review Letters* 118, no. 3 (2017): 037401. doi:10.1103/PhysRevLett.118.037401
11. Chen, D., Lander, G. R., Krowpman, K. S., Solomon, G. S., and Flagg, E. B. “Characterization of the Local Charge Environment of a Single Quantum Dot via Resonance Fluorescence” *Physical Review B* 93, no. 11 (2016): 115307. doi:10.1103/PhysRevB.93.115307
12. Flagg, E. B. and Solomon, G. S. “Optical Spin Readout Method in a Quantum Dot Using the Ac Stark Effect” *Physical Review B* 92, no. 24 (2015): 245309. doi:10.1103/PhysRevB.92.245309
13. Solomon, G. S., Flagg, E. B., Polyakov, S. V., Thomay, T., and Muller, A. “Manipulating Single Photons from Disparate Quantum Sources to Be Indistinguishable [Invited]” *Journal of the Optical Society of America B* 29, no. 3 (2012): 319–327. doi:10.1364/JOSAB.29.000319
14. Polyakov, S. V., Flagg, E. B., Thomay, T., and Solomon, G. S. “Dynamics of a Pulsed Single Photon Source” *AIP Conference Proceedings* 1508, no. 1 (2012): 67–74. doi:doi:10.1063/1.4773117
15. Polyakov, S. V., Flagg, E. B., Thomay, T., Migdall, A., and Solomon, G. S. “Time-Resolved Nonclassical Photon Field Characterization” *Conference on Lasers and Electro-Optics (CLEO)* (2012):
16. Flagg, E. B., Polyakov, S. V., Thomay, T., and Solomon, G. S. “Dynamics of Nonclassical Light from a Single Solid-State Quantum Emitter” *Physical Review Letters* 109, no. 16 (2012): 163601. doi:10.1103/PhysRevLett.109.163601
17. Polyakov, S. V., Muller, A., Flagg, E. B., Ling, A., Borjemscaia, N., Van Keuren, E., Migdall, A., and Solomon, G. S. “Coalescence of Single Photons Emitted by Disparate Single-Photon Sources: The Example of InAs Quantum Dots and Parametric Down-Conversion Sources” *Physical Review Letters* 107, no. 15 (2011): 157402. doi:10.1103/PhysRevLett.107.157402
18. Flagg, E. B., Muller, A., Polyakov, S. V., Ling, A., Migdall, A., and Solomon, G. S. “Interference of Single Photons from Two Separate Semiconductor Quantum Dots” *Proceedings of SPIE* 7948, no. 1 (2011): 794818-794818–7. doi:doi:10.1117/12.874853
19. Muller, A., Flagg, E. B., Lawall, J. R., and Solomon, G. S. “Ultrahigh-Finesse, Low-Mode-Volume Fabry-Perot Microcavity” *Optics Letters* 35, no. 13 (2010): 2293–2295. doi:10.1364/OL.35.002293

20. Flagg, E. B., Muller, A., Polyakov, S. V., Ling, A., Migdall, A., and Solomon, G. S. "Interference of Single Photons from Two Separate Semiconductor Quantum Dots" *Physical Review Letters* 104, no. 13 (2010): 137401. doi:10.1103/PhysRevLett.104.137401

21. Muller, A., Flagg, E. B., Metcalfe, M., Lawall, J., and Solomon, G. S. "Coupling an Epitaxial Quantum Dot to a Fiber-Based External-Mirror Microcavity" *Applied Physics Letters* 95, no. 17 (2009): 173101-173101–3. doi:doi:10.1063/1.3245311

22. Flagg, E. B., Robertson, J. W., Founta, S., Ma, W., Xiao, M., Salamo, G. J., and Shih, C.-K. "Direct Evidence of Interlevel Exciton Transitions Mediated by Single Phonons in a Semiconductor Quantum Dot Using Resonance Fluorescence Spectroscopy" *Physical Review Letters* 102, no. 9 (2009): 097402. doi:10.1103/PhysRevLett.102.097402

23. Flagg, E. B., Muller, A., Robertson, J. W., Founta, S., Deppe, D. G., Xiao, M., Ma, W., Salamo, G. J., and Shih, C. K. "Resonantly Driven Coherent Oscillations in a Solid-State Quantum Emitter" *Nature Physics* 5, no. 3 (2009): 203–207. doi:10.1038/nphys1184

24. Muller, A., Flagg, E. B., Bianucci, P., Wang, X. Y., Deppe, D. G., Ma, W., Zhang, J., Salamo, G. J., Xiao, M., and Shih, C. K. "Resonance Fluorescence from a Coherently Driven Semiconductor Quantum Dot in a Cavity" *Physical Review Letters* 99, no. 18 (2007): 187402. doi:10.1103/PhysRevLett.99.187402

25. U.S. Patent #7289220. "Broadband cavity spectrometer apparatus and method for determining the path length of an optical structure." Developed for the SEMATECH not-for-profit consortium of chip manufacturers in 2007.

Invited Talks (reverse chronological)

1.	Colloquium	University at Buffalo	Apr 27, 2023
	"Artificial Atoms and Quantum Optics"		
2.	Invited Conf. Talk	IEEE RAPID	Aug 12, 2020
	"Mimicking Magnetic Effects in a Quantum Dot with Light"		
3.	Colloquium	SUNY Geneseo	Nov 7, 2019
	"Artificial Atoms and Quantum Optics"		
4.	Seminar	Pittsburgh Quantum Institute	Oct 3, 2019
	"Artificial Atoms: Quantum Optics and Spin Physics of Quantum Dots"		
5.	Colloquium	Boston College	Sep 18, 2019
	"Artificial Atoms: Quantum Optics and Spin Physics of Quantum Dots"		
6.	Colloquium	Ohio University	Mar 25, 2016
	"Quantum Dots and Quantum Optics"		
7.	Condensed Matter Seminar; Indiana University Bloomington		Feb 13, 2015
	"Quantum Dots and Quantum Optics"		

Professional Service

- Member, Technical Committee on Quantum Optics of Atoms, Molecules, and Solids for the Conference on Lasers and Electro-Optics (CLEO); 2016 – 2018.
- Session chair at conferences:
  - Optical Society of America Incubator: Integrated Semiconductor Quantum Photonic Devices, 2017
  - Conference on Lasers and Electro-Optics, 2016, 2017.
  - American Physical Society Mid-Atlantic Section Meeting, 2015

- Refereed publications for journals: Physical Review Letters, Physical Review A, Physical Review B, Physical Review X, Physical Review Applied, Physical Review Research, Optica, Optica Quantum, Optics Letters, Nano Letters, Applied Physics Letters, Journal of Quantum Electronics, Physica Status Solidi, American Chemical Society Nano.
- *Ad hoc* proposal reviewer for National Science Foundation and Department of Energy Office of Science, 2014 – present.

Outreach

- Faculty adviser to WVU Quantum Technology Club (2020 – present)
- 4-H Optics Learning Module (2015 – 2020). Developed as part of CAREER grant educational activity.
- Celebrating Einstein, demonstrations (2017). Interdisciplinary celebration of the centennial of Einstein's prediction of gravitational waves. https://einstein.wvu.edu/
- Great American Solar Eclipse, demonstrations (sun spotter) (2017). Statewide community outreach event before and during the eclipse.
- Laboratory tours for students in Summer Science Camp and Pulsar Search Collaboratory (2015 – 2019)

Department Committee Service

- Chair of Admissions Committee (2023 – present)
- Undergraduate Advising Committee (2013 – 2023)
- Qualifier Reform Task Force (2016)
- Quantum Mechanics Qualifier Committee (2016 – 2022; Chair 2019)
- Electricity and Magnetism Qualifier Committee (2013 – 2015)
- Laser Safety Committee (2015 – 2016)
- Scholarship Committee (2018 – 2022; Chair 2021 – 2022)
- Social Committee (2018 – 2019)
- Faculty Search Committees: Biophysics; Teaching Assistant Prof. (x3); Condensed Matter Senior hire (2014 – 2021)

Mentorship

Nov, 2023: Completed *Mentoring Up* training from Center for the Improvement of Mentored Experiences in Research; 1-day in-person workshop.

Graduate Students

1. Disheng Chen, Jan 2014 – Aug 2017
   Graduated with Ph.D. Postdoctoral researcher at Nanyang Technological University in Singapore, studying NV centers in diamond. Principal Investigator, Optical Department at Multi-Field Low Temperature Technology (Beijing) Co., Ltd.
2. Gary R. Lander, Mar 2013 – Aug 2022
   Graduated with Ph.D. Postdoctoral researcher at National Energy Technology Laboratory.
3. Cabot Zabriskie, Aug 2013 – May 2015
   Graduated with M.S. Earned a Ph.D. from WVU in physics education research.
4. Raju Bhai KC, Aug 2015 – May 2023
   Graduated with Ph.D. Postdoctoral researcher at Los Alamos National Laboratory

5. Tristan Wilkinson, May 2017 – May 2022
   Graduated with Ph.D. Image Science Engineer at L3 Harris in Rochester, NY.
6. Fenton Clawson, Jan 2019 – present
7. Braden Warr, Sep 2020 – present
8. William Eshbaugh, Jan 2021 – present
9. Sulaiman Al Ghadani, Sep 2023 – present

Undergraduate Students

1. Samet Demircan, May 2013 – May 2017
   Graduated with B.S. Now a graduate student in physics at SUNY Stony Brook
2. Jennifer Mangano, Sept 2013 – Jul 2015
   Graduated with B.S. in business and economics.
3. Patrick Nelson, Mar 2014 – May 2016
   Graduated with B.S. Now a graduate student in physics at WVU
4. Samantha Isaac, Oct 2014 – May 2018
   Graduated with B.S. Now a graduate student in physics at U. Illinois Urbana-Champaign
5. Kyle Krowpman, Jan 2015 – May 2016
   Graduated with B.S. Now a graduate student in physics at Michigan State University
6. Jaxon Lee, May 2016 – Aug 2016
   Graduated with B.S. in math.
7. Joshua Cramlet, Sep 2016 – Sep 2018
   Graduated with B.S.
8. Cainan Nichols, Jan 2017 – May 2018
   Graduated with B.S. Earned M.S. in physics at Eastern Michigan University, 2020. Principal Systems Engineer at Northrup Grumman.
9. Collin Flood, Apr 2017 – May 2019
   Graduated with B.S. Business intelligence engineer for Berkshire Hathaway Specialty Insurance.
10. Kimberly Matsinger, May 2017 – July 2017
    Summer REU student from Slippery Rock University.
11. Cole Maurer, Aug 2017 – May 2021
    Graduated with B.S. Now a graduate student in physics at the University of New Mexico.
12. Eva Beeching, May 2018 – July 2018
    Summer REU student from Slippery Rock University.
13. Dillion Cottrill, May 2018 – May 2021

Graduated with B.S. Now a graduate student in physics at SUNY Stony Brook.

14. Samuel Cyphert, Aug 2018 – Dec 2019
    Mechanical/Aerospace Engineering major at WVU.

15. Sadie Chafin, Aug 2018 – May 2022
    Graduated with B.S.

16. Emma Martin, Aug 2019 – May 2020
    Graduated with B.S. in EE and minor in Physics. Now a graduate student in EE at Berkeley.

17. Anthony Southmayd, May 2021 – present
    Senior electrical and mechanical engineering major at WVU.

18. Bariana Wimmer, May 2021 – Dec 2022
    Graduated with B.S. Now a graduate student in physics at the University of Florida.

19. Jordan Stanley, Sep 2021 – Feb 2022
    Senior physics major at WVU.

20. Parker Hewitt, Jan 2022 – May 2023
    Graduated with B.S.

21. James Wheeler, Jan 2022 – May 2023
    Graduated with B.S.

22. Sulaiman Al Ghadani, May 2022 – Dec 2022
    Graduated with B.S. Now a graduate student in physics at WVU.

23. Aidan Sheppard, Aug 2023 – present
    Sophomore physics major at WVU.

24. Leo Weimer, Aug 2023 – present
    Junior physics major at WVU.

25. Russell Dillon, Sep 2023 – present
    Sophomore physics major at WVU.