Shellee D. Dyer

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Department of Electrical and Computer Engineering

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EDUCATION

1996 University of Utah **Ph.D. in Electrical Engineering**
Dissertation: Stellar Interferometry with Single-Mode Optical Fibers

1994 University of Utah **M.S. in Electrical Engineering**
Thesis: Planar Optical Waveguide Couplers for Immunosensor Applications

1990 University of Utah **B.S. in Electrical Engineering**

EXPERIENCE

7/2020 -Present **Weber State University** **Assistant Professor**

- Taught courses Electrical and Computer Engineering Courses
- Courses taught include fundamentals of electric circuits and introduction to electric circuits
- Developed curricula for a new senior- and graduate-level course in Fiber Optics Communications
- Developed educational curricula, wrote exams, and created unique lab experiments.
- Mentored students and provided feedback on exams, labs, and homework.
- Served on the Diversity and Inclusion Committee

8/2017 -8/2020 **Metro State of Denver** **Instructor of Engineering**

- Taught courses in Electrical Engineering Technology, Computer Engineering, and Sustainable Systems Engineering.
- Courses taught include circuits I and II, electronics, renewable energy, process control systems, microcontrollers, and programmable logic controllers.
- Earned excellent teaching evaluations.

7/1996 -7/2018 **NIST** **Senior Electronics Engineer**

Quantum Optics/Single-Photon Detectors Research:

- Fiber optics expert on large team; our result was first-ever quantum Bell experiment that is free of all major loopholes. This work received the 2017 John Stewart Bell Prize.
- Demonstrated quantum teleportation over 100 km of fiber, a world record distance.
- Demonstrated a distributed fiber temperature sensor with spatial resolution on the order of 1 cm using single-photon detectors with low timing jitter.
- Showed that correlated photon pairs can be generated in a CMOS-compatible silicon waveguide.
- Demonstrated an all-fiber source of entangled photon pairs.
- Demonstrated photon pair generation rates in excess of 10 MHz while maintaining coincidence-to-accidental rates greater than 100.
- Mentored five physics undergraduate students and one electrical engineering graduate student.

Optical Coherence Tomography Research:

- Designed and implemented a swept-laser fiber optic interferometric system for dispersion measurements. Demonstrated ability to measure dispersion of samples with uncertainty better than 20 fs.
- Created tissue phantoms from small (5-30 micron) polystyrene spheres in a glycerin/water solution. Demonstrated that the phase of light scattered from tissue phantoms is very sensitive to the size and refractive index of the spheres, indicating possible application to *in vivo* tissue morphology measurements and noninvasive cancer screening. Showed good agreement between measurements and Mie scattering theory.
- Demonstrated that the light scattered from a single spherical scatterer is non-minimum phase; therefore both magnitude and phase must be measured to completely characterize any sample of scatterers.
- Developed proposals on novel research ideas for internal and external funding. Authored a successful ATP proposal worth $1.2M.

Fiber Optic Component Characterization Research:

- Developed a low-coherence interferometric technique for measuring the group delay and reflectance of optical components.
- Characterized fiber Bragg gratings, hydrogen cyanide absorption cell, and bulk optic devices.
- Performed several intercomparisons between modulation-phase shift and interferometric group delay measurements and demonstrated agreement better than 0.3 ps at a wavelength resolution of 6 pm.
- Demonstrated the ability to characterize multiple fiber optic components in series from a single interferometric measurement.

- Compared measurements of the group delay of hydrogen cyanide to predictions based on a Kramers-Kronig calculation. Used result to verify measurement uncertainty analysis.
- Developed theory to predict the tradeoffs between signal-to-noise ratio, wavelength resolution, and group delay resolution in low-coherence interferometric dispersion measurements.
- Worked as part of a small team to assess industry's dispersion measurement uncertainty and propose improvements to industry associations.
- Supervised the research of one electrical engineering graduate student and four physics and engineering undergraduate students.

Fiber Optic Sensor Research:

- Demonstrated novel method of spectral tailoring an erbium fiber superfluorescent source for increased spectral width.
- Demonstrated wavelength-division multiplexing of closely spaced fiber Bragg grating sensors using Hilbert transform processing. Achieved measurement uncertainty better than 1 pm.
- Developed a novel method of measuring transverse strain with high-spatial resolution.

Diversity Team (Electronics and Electrical Engineering Laboratory):

- As co-chair for a team of 11 staff members, we developed a business case for diversity and established a travel fund for staff to visit minority-serving institutions for outreach and recruitment. Advised senior management on diversity programs and employee survey results. Arranged for diversity speakers and staff training.

NIST Summer Undergraduate Research Fellowship Committee (SURF):

- Team was responsible for evaluating all applications and making offers to successful candidates. We reviewed ~200 applications/year.
- Supervised the research of four physics undergraduate students.
- Personally championed the minority students. Successfully convinced senior management to increase funding for minority candidates.

HONORS/AWARDS

- Best Paper, Rocky Mountain Section, ASEE (2018)
- NIST Equal Employment Opportunity/Diversity Award (2005)
- National Research Council (NRC) Postdoctoral Fellowship (1996-1998)
- University of Utah Graduate Research Fellowship (1994-1995)
- Patricia Harris/Minority Engineering Graduate Fellowship (1990-1993)

COMMITTEES AND VOLUNTEER SERVICE

- Faculty Learning Community on Educating University Students with Autism
- NIST SURF (Summer Undergraduate Research Fellowship) Committee
- EEEL/NIST Diversity Team (co-chair)
- Science Fair Judge at Weber Elementary

SKILLS

- Matlab, Mathematica, Labview, UNIX/Linux, Raspberry Pi, Python

PUBLICATIONS (PEER-REVIEWED JOURNALS)

F. Marsili, M. Stevens, A. Kozorezov, V. Verma, C. Lambert, J. Stern, R. Horansky, **S. Dyer**, S. Duff, D. Pappas, A. Lita, M. Shaw, R. Mirin, and S. Nam, "Hotspot relaxation dynamics in a current-carrying superconductor," *Phys. Rev. B*, vol. 93, pp. 094518, 2016.

C. Gentry, J. Shainline, M. Wade, M. Stevens, **S. Dyer**, X. Zeng, F. Pavanello, T. Gerrits, S. Nam, R. Mirin, and M. Popovic, "Quantum-correlated photon pairs generated in a commercial 45-nm complementary metal-oxide semiconductor microelectronic chip," *Optica*, vol. 2, pp. 1065-1071, 2015.

L. Shalm, E. Meyer-Scott, B. Christensen, P. Beirhorst, M. Wayne, M. Stevens, T. Gerrits, S. Glancy, D. Hamel, M. Allman, K. Coakley, **S. Dyer**, C. Hodge, A. Lita, V. Verma, C. Lambrocco, E. Tortorici, A. Migdall, Y. Zhang, D. Kumor, W. Farr, F. Marsili, M. Shaw, J. Stern, C. Abellan, W. Amaya, V. Pruneri, T. Jennewein, M. Mitchell, P. Kwiat, J. Beinfang, R. Mirin, E. Knill, and S. Nam, "Strong loophole-free test of local realism," *Phys. Rev. Lett.,* vol. 115, pp. 250402, 2015.

H. Takesue, **S. Dyer**, M. Stevens, V. Verma, R. Mirin, S. Nam, "Quantum teleportation over 100 km of fiber using highly efficient superconducting nanowire single-photon detectors," *Optica*, vol. 2, pp. 832-835, 2015.

A. Kozorezov, C. Lambert, F. Marsili, M. Stevens, V. Verma, J. Stern, R. Horansky, **S. Dyer**, S. Duff, D. Pappas, A. Lita, M. Shaw, R. Mirin, S. Nam, "Quasi-particle recombination in hotspots in superconducting current-carrying nanowires," *Phys. Rev. B*, vol. 92, pp. 064504, 2015.

V. Verma, B. Korzh, F. Bussieres, R. Horansky, **S. Dyer**, A. Lita, I. Vayshenker, F. Marsili, M. Shaw, H. Zbindin, R. Mirin, S. Nam, "High-efficiency superconducting nanowire single-photon detectors fabricated from MoSi thin-films," *Opt. Express*, vol. 23, pp. 33792-33801, 2015.

S. Dyer, M. Tanner, B. Baek, R. Hadfield, and S.W. Nam, "Analysis of a distributed fiber-optic temperature sensor using single-photon detectors," *Opt. Express*, vol. 20, pp. 3456-3466, 2012.

M. Tanner, **S. Dyer**, B. Baek, R. Hadfield, and S.W. Nam, "High-resolution single-mode fiber-optic distributed Raman sensor for absolute temperature measurements using superconducting nanowire single-photon detectors, *Appl. Phys. Lett.*, vol. 99, pp. 201110, 2011.

S. Dyer, B. Baek, and S.W. Nam, "High-brightness, low-noise, all-fiber photon pair source," *Opt. Express*, vol. 17, pp. 10290-10297, 2009.

S. Dyer, B. Baek, M. Stevens, S.W. Nam, "High-efficiency, ultra-low noise all-fiber photon pair source," *Opt. Express*, vol. 16, pp. 9966-9977, 2008.

T. Dennis, **S. Dyer**, A. Dienstfrey, G. Singh, and P. Rice, "Analyzing quantitative light-scattering spectra of phantoms with optical coherence tomography," *J. Biomedical Optics*, vol. 13, 024004, 2008.

R. Espejo and **S. Dyer**, "Transverse-stress fiber Bragg grating sensor with high spatial resolution and temperature stability," *J. Lightwave Tech*., vol. 25, pp. 1777-1785, 2007.

R. Espejo and **S. Dyer**, "Practical spatial resolution limits of high resolution fiber Bragg grating sensors using layer peeling," *Measurement Science and Technology*, vol. 18, 1661-1666, 2007.

R. Espejo, M. Svalgaard, **S. Dyer**, "Characterizing fiber Bragg grating index profiles to improve the writing process," *IEEE Photon. Technol. Lett.*, vol. 18, pp. 2242-2244, 2006.

S. Dyer, T. Dennis, L. Street, S. Etzel, T. Germer, and A. Dienstfrey, "Spectroscopic phase-dispersion optical coherence tomography measurements of scattering phantoms," *Opt. Express*, vol. 14, no. 18, pp. 8138-8153, 2006.

S. Dyer and K. Rochford, "Low-coherence interferometric measurements of the dispersion of multiple fiber Bragg gratings," *IEEE Photon. Technol. Lett.*, vol. 13, pp. 230-232, 2001.

S. Dyer, K. Rochford, and A. Rose, "Fast and accurate low-coherence interferometric measurements of fiber Bragg grating dispersion and reflectance," *Opt. Express*, vol. 5, pp. 262-266, 1999.

S. Dyer and K. Rochford, "Low-coherence interferometric measurements of fiber Bragg grating dispersion," *Electron. Lett.*, vol. 35, pp. 1485-1486, 1999.

S. Dyer and D. Christensen, "Pupil size effects in fiber optic stellar interferometry," *J. Opt. Soc. Amer. A*, vol. 16, pp. 2275-2280, 1999.

K. Rochford and **S. Dyer**, "Demultiplexing of interferometrically interrogated fiber Bragg grating sensors using Hilbert transform processing," *J. Lightwave Technol.*, vol. 17, pp. 831-836, 1999.

K. Rochford and **S. Dyer**, "Reconstruction of minimum-phase group delay from fiber Bragg grating transmittance/reflectance measurements," *Electron. Lett.*, vol. 35, pp. 838-839, 1999.

S. Dyer and K. Rochford, "Spectral tailoring of erbium superfluorescent fiber source," *Electron. Lett.*, vol. 34, pp. 1137-1139, 1998.

S. Dyer and D. Christensen, "Dispersion effects in fiber optic interferometry," *Opt. Eng.*, vol. 36, pp. 2440-2447, 1997.

CONFERENCE AND OTHER PUBLICATIONS

C. Gentry, O. Magana Loaiza, M. Wade, F. Pavanello, T. Gerrits, S. Lin, J. Shainline, **S. Dyer**, S. Nam, R. Mirin, and M. Popovic, "Monolithic source of entangled photons with integrated pump rejection," in *Conference on Lasers and Electro-Optics*, paper JTh4C.3, May 2018.

S. Dyer, D. Swigert, and J. Proano, "Using mobile devices to improve engineering education: a process control laboratory example," in *ASEE Zone IV Conference*, March 2018.

L. Shalm, E. Meyer-Scott, B. Christensen, P. Beirhorst, M. Wayne, M. Stevens, T. Gerrits, S. Glancy, D. Hamel, M. Allman, K. Coakley, **S. Dyer**, C. Hodge, A. Lita, V. Verma, C. Lambrocco, E. Tortorici, A. Migdall, Y. Zhang, D. Kumor, W. Farr, F. Marsili, M. Shaw, J. Stern, C. Abellan, W. Amaya, V. Pruneri, T. Jennewein, M. Mitchell, P. Kwiat, J. Beinfang, R. Mirin, E. Knill, and S. Nam, "A strong loophole-free test of local realism," in *Conference on Lasers and Electro-Optics*, paper FW4C, May 2016.

A. Kozorezov, **S. Dyer**, R. Horansky, R. Mirin, "Dynamics of hotspots in superconducting nanowires," in *Conf. on Low Temperature Devices*, Grenoble, Spain, July 2015.

S. Dyer, H. Takesue, M. Stevens, V. Verma, R. Horansky, R. Mirin, and S. Nam, "High performance superconducting nanowire single-photon detectors: metrology and applications to quantum teleportation," in *Single Photon Workshop*, Geneva, Switzerland, July 2015.

S. Nam, B. Calkins, **S. Dyer**, R. Horansky, A. Lita, V. Verma, I. Vayshenker, "Precision measurements of system detection efficiency for high efficiency superconducting detectors," in *Single Photon Workshop*, Geneva, Switzerland, July 2015.

C. Gentry, M. Wade, J. Shainline, X. Zeng, M. Stevens, **S. Dyer**, F. Pavanello, S. Nam, R. Mirin, and M. Popovic, "Microresonator source of photon pairs integrated in 45 nm CMOS," in *Single Photon Workshop*, Geneva, Switzerland, July 2015.

S. Dyer, H. Takesue, V. Verma, R. Horansky, R. Mirin, S. Nam, "Polarization-insensitive superconducting nanowire single-photon detectors," in *CLEO/QELS*, San Jose, CA, May 2015.

H. Takesue, **S. Dyer**, M. Stevens, V. Verma, R. Mirin, S. Nam, "Quantum teleportation over 100 km of fiber using MoSi superconducting nanowire single-photon detectors," in *CLEO/QELS*, San Jose, CA, May 2015.

F. Marsili, M. Stevens, A. Kozorezov, V. Verma, C. Lamber, J. Stern, R. Horansky, **S. Dyer**, M. Shaw, R. Mirin, S. Nam, "Hotspot dynamics in current carrying WSi superconducting nanowires," in *CLEO/QELS*, San Jose, CA, May 2015.

S. Dyer, L. Wadleigh, V. Verma, S. Nam, "Widely-detuned all-fiber photon pair source in standard telecom fiber," in *CLEO/QELS*, San Jose, CA, 2014.

F. Marsili, M. Stevens, A. Kozorezov, V. Verma, C. Lambert, J. Stern, R. Horansky, **S. Dyer**, M. Shaw, R. Mirin, and S. Nam, "Hotspot dynamics in current carrying WSi superconducting nanowires," in *CLEO/QELS*, San Jose, CA, 2014.

S. Dyer, B. Baek, S.W. Nam, M. Tanner, and R. Hadfield, "High spatial resolution distributed fiber sensor using Raman scattering in single-mode fiber," in *CLEO/QELS*, 2010.

S. Dyer, L. Pellouchoud, and S. Nam, "Ultra-low noise photon pair source in dispersion-shifted optical fiber," in *Southwest Quantum Information and Technology*, Feb. 2008.

T. Dennis, **S. Dyer**, and A. Dienstfrey, "Phase-dispersion light-scattering for quantitative size-imaging of spherical scatters," in *Biomedical Applications of Light Scattering*, 2007.

S. Dyer, L. Street, S. Etzel, T. Dennis, A. Dienstfrey, V. Tsvankin, and W. Tan, "Characterization of cell and tissue samples from measurements of spectroscopic phase-dispersion," in *Biomedical Applications of Light Scattering*, Jan. 2007.

R. Espejo and **S. Dyer**, "Transverse stress measured by four-polarization-state frequency domain interferometry at high spatial resolution," in *Optical Fiber Sensors Conference*, Oct. 2006.

S. Dyer, T. Dennis, P. Williams, L. Street, S. Etzel, R. Espejo, T. Germer, and T. Milner, "High sensitivity measurements of the scattering dispersion of phantoms using spectral domain optical coherence tomography," in *Coherence Domain Optical Methods and Optical Coherence Tomography in Biomedicine X*, Proc. SPIE vol. 6079, pp. 607943-1, 2006.

R. Espejo and **S. Dyer**, "High spatial resolution measurements of transverse stress in a fiber Bragg grating using four-state analysis low-coherence interferometry and layer peeling," in *Smart Structures and Materials*, Proc. SPIE vol. 6167, pp. 616707-1, 2006.

S. Dyer, P. Williams, R. Espejo, J. Kofler, and S. Etzel, "Fundamental limits in fiber Bragg grating peak wavelength measurements," **Invited Paper**, in *17th Int. Conf. Opt. Fiber Sensors*, Bruges, Belgium, May 2005.

R. Espejo, M. Svalgaard, and **S. Dyer**, "Analysis of a fiber Bragg grating writing process using low-coherence interferometry and layer-peeling," in *Symposium on Optical Fiber Meas*., Boulder, CO, pp. 195-198, Sept. 2004.

S. Dyer, P. Williams, R. Espejo, J. Kofler, and S. Etzel, "Key metrology considerations for fiber Bragg grating sensors," in *Smart Structures and Materials: Smart Sensor Technology and Measurement Systems*, Proc. SPIE vol. 5384, pp. 181-189, 2004.

S. Dyer, J. Kofler, R. Espejo, and S. Etzel, "Stability of fiber Bragg grating wavelength calibration references," in *Conf. on Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides*, Monterey, CA, pp. 55-57, Sept. 2003.

S. Dyer, R. Espejo, and P. Williams, "High-resolution group delay measurements of a hydrogen cyanide gas cell using low-coherence interferometry," in *Symposium on Optical Fiber Meas*., Boulder, CO, pp. 45-48, Sept. 2002.

W. Swann, **S. Dyer**, and R. Craig, "Four-state measurement method for polarization dependent wavelength shift," in *Symposium on Optical Fiber Meas.,* Boulder, CO, pp. 125-128, Sept. 2002.

S. Dyer and R. Espejo, "Fast and accurate characterization of optical components using low-coherence interferometry," **Invited Talk**, in *Conf. on Laser and Electro-optics/Pacific Rim*, Chiba, Japan, Jul. 15-19, 2001.

S. Gilbert, **S. Dyer**, P. Williams, and A. Rose, "Optical metrology for wavelength-division-multiplexed fiber communications," *Optics and Photonics News*, pp. 44-48, Mar. 2001.

S. Dyer, A. Rose, and K. Rochford, "Fast and accurate measurement of the dispersion of cascaded components," in *Opt. Fiber Comm. Conf.*, Anaheim, CA, paper no. ThB5, Mar. 2001.

S. Dyer, K. Rochford, "A fast and accurate measurement of both transmission and reflection group delay in fiber Bragg gratings," in Symposium on Optical Fiber Meas., Boulder, CO, pp. 169, (2001).

A. Rose, C. Wang, **S. Dyer**, "Fiber Bragg grating metrology round robin: telecom group," in *Symposium on Optical Fiber Meas*., Boulder, CO, pp. 161, (2001).

A. Rose, C. Wang, and **S. Dyer**, "Round robin for optical fiber metrology," *J. Res. Natl. Inst. Stand. Technol.*, vol. 105, pp. 839-866, Nov./Dec. 2000.

K. Rochford, R. Espejo, A. Rose, and **S. Dyer**, "Improved fiber-optic magnetometer based on iron garnet crystals," in *14th Int. Conf. Opt. Fiber Sensors*, Venice, Italy, SPIE vol. 4185, pp. 332-335, 2000.

S. Dyer and K. Rochford, "A fast and accurate measurement of both transmission and reflection group delay in fiber Bragg gratings," in *Symposium on Optical Fiber Meas.*, Boulder, CO, pp. 169-172, 2000.

K. Rochford and **S. Dyer**, "Dense wavelength division multiplexing of interferometrically interrogated fiber Bragg grating sensors," in *13th Int. Conf. Opt. Fiber Sensors*, Kyongju, Korea, April 13-16, 1999.

S. Dyer and K. Rochford, "Spectral tailoring of an erbium superfluorescent fiber source," Postdeadline Session of the *12th Int. Conf. Opt. Fiber Sensors*, Williamsburg, VA, Oct. 28-31, 1997.

D. Christensen, **S. Dyer**, D. Fowers, and J. Herron, "Analysis of excitation and collection geometries for planar waveguide immunosensors," in *Fiber Optic Sensors in Medical Diagnostics,* Proc. SPIE vol. 1886, pp. 2-8, 1993.

J. Herron, K. Caldwell, D. Christensen, **S. Dyer**, V. Hlady, P. Huang, V. Janatova, H. Wang, and A. –P. Wei, "Fluorescent immunosensors using planar waveguides," in *Advances in Fluorescent Sensing Technology*, Proc. SPIE vol. 1885, pp. 28-39, 1993.

D. Christensen, **S. Dyer**, J. Herron, and V. Hlady, "Comparison of robust coupling techniques for planar waveguide immunosensors," in *Chemical, Biochemical, and Environmental Fiber Sensors IV*, Proc. SPIE vol. 1796, pp. 20-25, 1992.

D. Christensen, **S. Dyer**, J. Kimmel, and J. Herron, "Evanescent coupling in a waveguide fluoroimmunosensor," *in Fiber Optic Medical and Fluorescent Sensors and Applications*, Proc. SPIE vol. 1648, pp. 223-226, 1992.

S. Dyer, D. Christensen, V. Hlady, and J. Herron, "Optical couplers for planar waveguide immunosensors," in *3rd Annual Fall Meeting of the Biomed. Eng. Soc.*, Salt Lake City, UT, Oct. 16-18, 1992.

J. Herron, K. Caldwell, D. Christensen, **S. Dyer**, V. Hlady, P. Huang, V. Janatova, H. Wang, and A. –P. Wei, "Fluorescent immunosensors using planar waveguides," in *3rd Annual Fall Meeting of the Biomed. Eng. Soc.*, Salt Lake City, UT, Oct. 16-18, 1992.

D. Christensen, **S. Dyer**, J. Herron, and V. Hlady, "New coupling techniques and sensitivity analysis for planar waveguide immunosensors," in *1st European Conf. on Optical Chemical Sensors and Biosensors*, Graz, Austria, April 12-15, 1992.

OTHER CONTRBUTIONS

"Supporting learning in students with autism: Strategies that benefit all students," Strong Institutional Practice (SIP), MSU Denver *Early Bird Magazine,* Oct. 31, 2019.

"No, quantum teleportation won't let us send instant messages to Alpha Centauri," *Air and Space Magazine*, Aug. 10, 2017.