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Brandon Long, Ph.D.

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Professional Profile

Dr. Long is a highly skilled optical scientist with expertise in using selective micro- and nanoscale techniques to manipulate materials for manufacturing and probing high-complexity samples. He has used novel scanning probe techniques to perform studies of polymer morphologies, especially as they relate to conducting polymer thin film devices.

Dr. Long has also developed high precision, custom scanning probe devices for various applications, including MEMS manufacturing of optical force probes and the study of nanoscale nonlinear optical effects within 2-D materials.

Dr. Long's expertise also includes highly specific spectroscopic analysis, including biochemical analysis on degraded, complex biological samples. He has used this expertise to study fossilized remains in search of endogenous heme. He has also studied the optical properties of aerosols in remote sensing applications.

He is skilled in many forms of scanning probe microscopy, including Near-field Scanning Optical Microscopy (NSOM), Atomic Force Microscopy (AFM), and Scanning Tunnelling Microscopy (STM); Raman measurements, including resonance Raman techniques; Mie and T-matrix scattering analysis; ellipsometry; as well as various MEMS manufacturing techniques.

Academic Credentials & Professional Honors

Ph.D., Physics, North Carolina State University, 2019

B.S., Physics, North Carolina State University, 2010

Prior Experience

Single Particle Measurement Post doctorate Fellow, North Carolina State University, 2020

Scanning Probe Technician on Non-Linear NSOM, North Carolina State University, 2017-2019

Experimental Physics Graduate Researcher, North Carolina State University, 2010-2019

Physics Undergraduate Lecturer, North Carolina State University, 2014

Aerosol Research Staff, North Carolina State University, 2011-2013

Professional Affiliations

American Physics Society (APS)

Society for Photonics and (SPIE)

Languages

German

Publications

Long, B. (2019). Morphology, Chemistry and Domain Studies of Disparate Mesoscale Organic Systems: Patterned Conjugated Polymers and Preserved Ancient Molecules. North Carolina State University.

Hallen, H. D., & Long, B. J. (2019, September). Resonance Raman techniques for complex biological systems. In Ultrafast Nonlinear Imaging and Spectroscopy VII (Vol. 11122, p. 111220N). International Society for Optics and Photonics.

Hallen, H. D., Long, B. J., Hook, D. A., Pangle, G. E., & Philbrick, C. R. (2013, May). Multistatic lidar measurements of non-spherical aerosols. In Laser Radar Technology and Applications XVIII (Vol. 8731, p. 87310P). International Society for Optics and Photonics.

Long, B. J., Hook, D. A., Pangle, G. E., Hallen, H. D., & Philbrick, C. R. (2013, May). Using a laser aureole to study aerosols. In Laser Radar Technology and Applications XVIII (Vol. 8731, p. 87310O). International Society for Optics and Photonics.

Hook, D. A., Pangle, G. E., Long, B. J., Philbrick, C. R., & Hallen, H. D. (2013, May). Understanding lidar returns from complex dust mixtures. In Laser Radar Technology and Applications XVIII (Vol. 8731, p. 87310M). International Society for Optics and Photonics.

Hallen, H. D., Long, B. J., Hook, D. A., Pangle, G. E., & Philbrick, C. R. (2013, May). Multistatic lidar measurements of non-spherical aerosols. In Laser Radar Technology and Applications XVIII (Vol. 8731, p. 87310P). International Society for Optics and Photonics.

Presentations

Brandon J.N. Long, Wenxia Zheng, Mary Schweitzer, Hans D. Hallen; Resonance Raman Measurements on Fossilized Remains show Ancient Heme-Globin Complex, APS March Meeting, March 2021

Brandon J.N. Long, Wenxia Zheng, Mary Schweitzer, Hans D. Hallen; Resonance Raman Imagery of Semi-Fossilized Soft Tissues, SPIE Optics + Photonics, August 2018 (Invited)

Brandon J.N. Long, Evan R. Adamek, Hans D Hallen; Direct nanoscale patterning of in-plane-aligned polymer via split-tip NSOM, APS March Meeting 2019

Ling Li, Shuang Fang Lim, Alexander Puretzy, Brandon J.N. Long, Robert Riehn, Hans D. Hallen; DNA methylation detection using UV nano bowtie enhanced Raman spectroscopy, SPIE Optics + Photonics, August 2018

Brandon J.N. Long, D. A. Hook, Garret E. Pangle, Hans D. Hallen, C. Russell Philbrick; Using a laser aureole to study aerosols, SPIE DSS, May 2013.

Hans D. Hallen, Brandon J. N. Long, D. Adam Hook, Garrett E. Pangle, and C. Russell Philbrick; Multistatic lidar measurements of non-spherical aerosols, SPIE DSS, May 2013.

D. Adam Hook, Garrett E. Pangle, Brandon J.N. Long, C. Russell Philbrick, and Hans D. Hallen; Understanding lidar returns from complex dust mixtures, SPIE DSS, May 2013.

Garrett E. Pangle, D. Adam Hook, Brandon J. N. Long, C. Russell Philbrick, and Hans D. Hallen; Optical extinction dependence on wavelength and size distribution of airborne dust, SPIE DSS, May 2013.

Project Experience

- Discovered and characterized a temperature-dependent superfluorescence process in Upconverting Nanoparticles, including developing cooling solutions for ultrafast measurements.
- Developed single particle NSOM (Near-field Scanning Optical Microscope) functionalized tips, including attaching single particles to nanoscopic structures and calibrated nano-Newton force measurements.
- Measured the luminescence response to stress of single upconverting nanoparticles and characterized a novel strain-dependent UCNP emission wavelength shift.
- Used a micro-Raman system to analyze organic material with tightly defined microscale chemical domains found in dinosaur bones for hemoglobin.
- Used Resonance techniques to create a double-selectivity test to focus on single molecular constituents within highly degraded, heterogenous materials.
- Implemented non-linear background subtraction methods to deal with fluorescent backgrounds.

- Used micro-Raman systems to create a spectral images of tissues and extra-cellular matrices.
- Used a micro-Raman system to probe for iron impurities in a diamond-like coating.
- Extensive experience with low-light, low-signal spectroscopic analysis.
- Used a custom NSOM (Near-field Scanning Optical Microscope) to fabricate highly controlled polymer alignment.
- Used solvent vapor annealing techniques to allow for monomer-by-monomer polymer manipulation.
- Built an NSOM that met intensive experimental constraints, including the ability to heat and wet a sample while maintaining a mechanically stable environment for 12-24 hour scanning probe acquisition.
- Fabricated unique NSOM probes with two electrodes (Split-tip probes), including improving manufacturing processes to reduce processing time from 1 month to 5 seconds.
- Created a novel NSOM apparatus for non-linear optical measurements.
- Led training, development, and maintenance of NSOM apparatus for a new lab, including remote maintenance of NSOM apparatus and training new users on NSOM techniques.
- Created field measurement apparatuses for Multistatic aerosol scattering and Aureole aerosol scattering.
- Performed field measurements of aerosol scattering by variously dense dust clouds, in collaboration with other groups
- Used Mie and T-matrix modeling to predict aerosol particulate index of refraction.
- Developed a tabletop apparatus for measuring aureole scattering of aerosols suspended in a viscous medium, replacing cloud chamber measurements.
- Performed dust index of refraction measurements, from visible to IR wavelengths.