Physics Seminar

Wednesday, February 5, 2020
132 Oelman Hall 12:20 – 1:15

Applications of Optical Scatter in Remote Sensing, Scene Generation, Metamaterials, and Reflective Inverse Diffusion

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Optical scatter--transmission, reflection, and absorption/emission--are fundamental physical processes of use in remote sensing, scene generation, metamaterials, and reflective inverse diffusion. In this presentation, a brief overview of scatter in general is provided, followed by a brief discussion of metamaterials (thin lenses) and reflective inverse diffusion (making rough surface scatter appear polished). Then, a more thorough discussion of a recent collaboration between Wright State University and the Air Force Institute of Technology on researching the bidirectional reflectance distribution function (BRDF) is discussed. The BRDF describes optical scattering off realistic surfaces. The microfacet BRDF, while computationally simple, lacks accuracy especially for grazing angles. An approximation, which replaces mathematically problematic elements of the microfacet model with the polarization factor from wave optics, has proved useful in accurately modeling the grazing region. This analysis is expanded upon by additionally varying the microfacet distribution function—a fundamental part of microfacet BRDF models. In these modified results, after choosing the best microfacet distribution, 12 of the 18 materials studied show a significant improvement in the BRDF fit at grazing angles.

Professional Biography:

Samuel Butler is currently a Lieutenant Colonel in the United States Air Force. He obtained a Bachelor's Degree in Applied Physics with a Computer Science Emphasis from Brigham Young University in 2004, a Master's Degree in Applied Physics from the Air Force Institute of Technology in 2010, and a Doctoral Degree in Engineering Physics from the Air Force Institute of Technology in 2015. Lieutenant Colonel Butler has served at Minot Air Force Base, North Dakota; Fort Meade, Maryland; and Eglin Air Force Base, Florida. He also has been deployed to Southwest Asia in 2011 and 2016. Lieutenant Colonel Butler is currently an Assistant Professor of Physics at the Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio. He is here to talk to us about applications of the physics of optical scatter in remote sensing, scene generation, metamaterials, and reflective inverse diffusion.