The Robert W. Courter Seminar Series

3:00-4:00pm, Friday, January 31st, 2020
1263 Patrick F Taylor Hall

Probabilistic data analysis in laser-based nanoparticle diagnostics

by **Kyle Daun**[*]

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Laser-based diagnostics, including line-of-sight attenuation (LOSA) spectroscopy, multiangle light scattering (MALS) and laser-induced incandescence (LII), are mainstay tools for measuring soot in combustion-related applications. They have also been applied to characterize aerosols of metal and metalloid nanoparticles to develop gas phase synthesis routes, and, increasingly, to characterize fundamental thermodynamic properties of materials at extreme temperatures. In all these applications, it is crucial to quantify the uncertainty in the derived parameters, particularly since the inference procedures for these diagnostics are often mathematically ill-posed. This talk reviews how Bayesian data analysis can be used to quantify uncertainty caused by measurement noise and model error, how data from multiple measurement modalities and prior information can be combined to mitigate illposedness, and how Bayesian model selection can be used to identify the most probable measurement model.

[*] Kyle Daun is an Associate Professor in the Department of Mechanical and Mechatronics Engineering at the University of Waterloo. His research focuses on metrology and the application of inverse analysis to radiative transfer. His research interests include: laser-induced incandescence and multiangle elastic light scattering on aerosolized nanoparticles; chemical species tomography of turbulent flows; flare emission quantification through remote sensing; and industrial pyrometry during steel manufacturing. His doctoral research at the University of Texas at Austin focused on inverse design and optimization of radiant enclosures. He subsequently was an NSERC postdoctoral fellow and research officer at the National Research Council Canada, where he worked on laser-based combustion diagnostics, before joining the University of Waterloo in 2007. In 2010 Professor Daun received the JQSRT Ray Viskanta Award. He is a Humboldt fellow, a DFG Mercator Fellow, and a Fellow of the ASME.