UNIVERSITY of DAYTON

EOP/ECE Colloquium
KL 304
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Accurate Sensing of the Complex Refractive Index and Particle Size in Highly Opaque Scattering Media

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Abstract

We demonstrate a first *accurate* optical sensor of the complex refractive index and particle size in highly opaque light-scattering samples. We achieve this by observing the real-time reflectance profile of a divergent laser beam that is incident on the sample surface and accurately modeling the reflectance measurements *over the full range of incident angles*, i.e., for reflectivity-values going from unity in the total internal reflection regime to nearly zero when almost all the light is transmitted. Our methodology is in direct contrast to the prevalent approach of considering only the critical angle region, which is just a small subset of the entire reflectance data.

No reliable reference data exist for complex refractive index of highly opaque scattering media. Our claim of accuracy is based on three key features of our work. First, our measurements do not require any sample dilution, thus eliminating dilution errors. Secondly, our model does not employ any fitting parameters other than the two quantities we seek to determine i.e., the real and imaginary parts of the refractive index, thus eliminating ambiguities that arise from over-fitting. Finally, we extract the average scatterer particle size from the complex refractive index and obtain good agreement with an independent particle size measurement by dynamic light scattering (DLS).

Potential applications in biosensing and solar technology will be discussed.

Brief Biography

Dr. Samir Bali is Associate Professor of Physics at Miami University. He received his BSc from Lucknow University, India in 1986 and his PhD from the University of Rochester in 1994. His areas of research interest include quantum optics, optical lattices, optical and atomic Physics, where he is interested in the dynamics of ultracold (microKelvin!) atoms organized in “optical lattices” by lasers, for applications in nanolithography and quantum computing. His other interests are in electromagnetically induced transparency (EIT) and absorption (EIA), for application in ultra-sensitive magnetometry, and in optical sensing of turbid (i.e., highly scattering) media for bio/environmental/petroleum applications.

All are invited!
Light refreshments will be served.

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