Milos Sormaz et al., J Phys Chem Biophys 2013, 3:5
http://dx.doi.org/10.4172/2161-0398.S1.002

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October 07-09, 2013 Hilton San Antonio Airport, TX, USA

Influence of different scattering phase functions on the breakdown of the continuum limit approximation to the discrete scattering events

Milos Sormaz[1], Ursina Caluori[2], Mathias Reufer[3] and Klaus Simon[2]
[1]Sormaz Consulting, Switzerland
[2]Swiss Federal Laboratories for Materials Science and Technology (EMPA), Switzerland
[3]LS-Instruments AG, Switzerland

The question under what conditions the transport of light can be considered to be diffused has high importance in many fields like biomedical optics (diffuse optical imaging) and diffusing wave spectroscopy. The diffusion equation, which is widely used in the aforementioned fields, predicts an average time- of-flight of transmitted light that is 11 % larger than measurements for $L/l^* = 10$, with L and l* being the sample thickness and the transport mean free path length, respectively. The discrepancy also grows with the scattering anisotropy. Autocorrelation functions g1 of weakly scattered light (e.g. backscattered light) can be accurately predicted by abandoning the so-called continuum limit approximation, employed by using diffusion equation to describe light transport and obtain path length distributions P(s), and taking into account the discrete nature of scatterers through the square momentum transfer distributions P(y) obtained with Monte Carlo simulations. The continuum limit approximation can be employed when $y=2k^2s/l^*$ (with k being the wave number), which holds for diffuse light. Recently, the breakdown of the continuum limit approximation (i.e. the nonlinear proportionality between square momentum transfer y and path length s) was revealed using Monte Carlo simulations when transmitted light was detected. The sample was composed of 400 nm polystyrene spheres embedded in water. The results showed that P(y) instead of P(s) has to be used to calculate g1 for samples with $L/l^* < 14$. Here, the experimental and numerical results for other two samples composed of 200 nm and 980 nm polystyrene spheres embedded in water are presented to show dependence on the scattering anisotropy. The backscattered light is also considered due to an opposite relation between y and s for short trajectories compared to the transmitted light; i.e. the backscattered unlike the transmitted light must experience large-angle scattering events in order to have short path lengths, thus having large y.

Biography

Milos Sormaz has finished in 2010, after three and a half years, his Ph.D. from Swiss Federal Institute of Technology Zurich. Afterwards, he was two years a Post - Doc at Swiss Federal Laboratories for Materials Science and Technology. He has published six papers in reputed journals, two conference papers, supervised several master and bachelor theses, and was a co-author of one book chapter during his academic career. Currently, he is doing research as a free lancer.

Milos.Sormaz@empa.ch