

## DEPENDENT SCATTERING PREVAILS IN NANOEMULSIONS

Ricardo Martinez, Abhinav Bhanawat, Refet Ali Yalçin, Laurent Pilon\*

<sup>1</sup> Mechanical and Aerospace Engineering Department, Henry Samueli School of Engineering and Applied Science, University of California, 420 Westwood Plaza, Los Angeles, CA 90095, USA

**ABSTRACT.** The optical transparency of concentrated and thick oil-in-water nanoemulsions has been observed to increase with increasing oil volume fraction. This study demonstrates experimentally and numerically that such unusual behavior is due to dependent scattering. Here, silicone oil-in-water nanoemulsions were prepared with volume fraction ranging from 1% to 20% and peak droplet diameter of 33 nm. The spectral normal-hemispherical transmittance of these different nanoemulsions in 10 mm thick cuvettes was measured experimentally in the visible. Numerical predictions accounting for dependent scattering using the recently developed radiative transfer with reciprocal transactions ( $R^2T^2$ ) method were in good agreement with experimental measurements. Simulations revealed that solving the radiative transfer equation assuming independent scattering or using the Beer-Lambert law underestimated the normal-hemispherical transmittance for oil volume fraction greater than 1%. The results could be used to characterize nanoemulsions, to investigate their formation and stability, and to achieve a desired appearance for food and cosmetics applications.

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\*Corresponding Laurent Pilon\*: [pilon@seas.ucla.edu](mailto:pilon@seas.ucla.edu)