# Abstract

## Scaling Conditions for Multiple Scattering in Fractal Aggregates[1]

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It is well know that under the first Born approximation, the cross section $d\sigma/d\Omega$ for light scattering from a fractal of dimension $d_f$ scales with wavevector $Q$ as $Q^{-d_f}$. The use of this formula to interpret scattering experiments performed at frequencies close to the resonances of the system is questionable, as multiple scattering cannot be neglected. In a previous work we studied the scaling properties of the light scattered by colloidal aggregates,[2] employing a novel multi-resolution hierarchical algorithm which allowed us the study of large systems taking fully into account the long-range of the interactions in multiple scattering calculations. Employing a scalar approximation, we obtained the conditions under which scaling may be present. Here we extend that work accounting fully for the vectorial nature of the polarization. We find that even under resonant conditions, the scattering cross section may scale with the fractal dimension $d_f$, but only if the aggregate is larger than a dissipation and frequency dependent length-scale $L_\hbar$. For smaller aggregates, $d\sigma/d\Omega$ might scale with a different exponent or it might not scale at all, depending on the frequency of light employed. This could explain the discrepancies between experiments performed on similar systems within the strong scattering regime.

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