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Phosphorylation for Dispersion Spectrum Prediction of Dielectric Spheroidal Particles

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Abstract: In this paper a novel phosphorylation technique is used for dielectric spheroidal particles to predict the dispersion spectrum. The results are in good agreement with the reported results.

Keywords: Dielectric spheroidal particles, Phosphorylation, Dispersion characteristics.

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1. Introduction and Main Results

Dielectric spheroidal particles are used in microwave and optical frequency ranges. The scalar Helmholtz equation

$$\nabla^2 \psi + k^2 \psi = 0 \qquad \text{in } V_1 \text{ and } V_2 \qquad (1)$$

$$\psi = \psi_i + \psi_s \qquad \text{in } V_1 \qquad (2)$$

$$\psi = \psi_t \qquad \text{in } V_2 \qquad (3)$$

$$\frac{\partial \psi_i}{\partial n} + \frac{\partial \psi_s}{\partial n} = \frac{\partial \psi_t}{\partial n} \qquad \text{on } S \qquad (4)$$

$$\frac{\partial \psi_t}{\partial n} = \frac{\partial \psi_i}{\partial n} + \frac{\partial \psi_s}{\partial n} \qquad \text{on } S \qquad (5)$$

$$\psi_s \to 0 \qquad \text{as } r \to \infty \qquad (6)$$

$$\frac{\partial \psi_s}{\partial r} - ik\psi_s = o\left(\frac{1}{r}\right) \qquad \text{as } r \to \infty \qquad (7)$$

$$\psi_t \text{ is finite} \qquad (8)$$

$\nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$, $k = \frac{2\pi}{\lambda}$, λ is the wavelength, ψ_i is the incident wave, ψ_s is the scattered wave, ψ_t is the transmitted wave, V_1 is the exterior region, V_2 is the interior region, S is the surface of the particle, n is the outward normal to S, r is the radial distance from the origin, $i = \sqrt{-1}$, $o(\cdot)$ is the Landau symbol, $\partial/\partial n$ denotes the normal derivative and ψ is the total field.

In scattering theory, ψ_i is given and ψ_s and ψ_t are to be determined.

In Section 2, we use the phosphorylation technique to obtain the dispersion spectrum for the scattering of a plane wave by a dielectric spheroidal particle. In Section 3, we compare our results with the reported results. In Section 4, we conclude the paper.

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