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Optical trapping of the anisotropic crystal nanoparticle

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For modeling optical trapping of an anisotropic nano-particle we first used the point matching method to compute the T-matrix coefficients based on the boundary condition for the normal componants of D-fields. In the anisotropic media, where the divergence of E-field is nonzero, the Maxwell wave equations was sloved in the Fourier space. Thus, the plan waves with angular spectrum amplitude distributions can be expanded into the orthogonal and complete set of the Vector Spherical Wave Functions. The E-field eigenvectors can be obtained by the characteristic equation. In the point-matching mthod however we do not need to solve the entire internal field in the anisotropic particle, but an expression of the unknown internal field at the boundaries. We computed the stress distribution on the interfaces of an anisotropic nanocylinder and the related total lateral torque, spin torque and total force in the optical tweezers in order to put in evidence for mecanism of the optical trap of the anisotropic particle. The trapping beam was modeled as the vector Gaussian beam with high order corrections. After solving the scattered field the radiation stress was computed through the Maxwell stress tensor for anisotropic media by Robinson. Our calculation showed that optical stress can be not normal to the interface of anisotropic media. Our calculation predicted that when the optical axes of the anisotropic nanocylinder are not aligned with the cylinder axis, the nanocylinder can be trapped inclined with respect to the beam axis at an equilibrium position. Preliminary experimental observations came to support this prediction.
Abstract (100 words)
T-matrix

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