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Scattering of off-axis high-order Hermite-Gaussian beam by an anisotropic coated dielectric sphere

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The scattering of isotropic dielectric sphere coated with an anisotropic material layer illuminated by a high-order Hermite-Gaussian beam is investigated. Incident high-order Hermite-Gaussian beam is expanded in terms of spherical vector wave functions (SVWFs) using complex source point method. Using the Fourier transformation and eigenfunctions, the field expression in anisotropic coated layer can be obtained in spectral domain as the addition of the first and second spherical vector wave functions. Combing with the continuous boundary condition of tangential component of electromagnetic field in two interfaces between the isotropic medium, the anisotropic medium and the free space, the unknown expansion coefficients of the scattered field and internal field can be obtained by solving the equations. The angular distributions of radar cross section (RCS) of scattered field of different anisotropic medium with various thicknesss are numerically simulated. When the inner isotropic sphere radius reduces to zero, the result agrees well with that of homogeneous anisotropic sphere. The scattered fields produced by high-order Hermtie-Gaussian beam are also compared with those by Gaussian beam. The results show that for on-axis high-order Hermtie-Gaussian beam incidence, the maximum scattered field does not appear necessarily in the forward direction as the Gaussian beam does. The effects of inner and outer sphere radius, anisotropy, the position of beam center and the high-order Hermtie-Gaussian beam mode on the angular distribution of RCS are also discussed in detail. The theoretical development can be applied in the detection of mononuclear blood cell and other biological cells.