Commission B: FIELS AND WAVES
(b) Scattering and diffraction

STATISTICAL CHARACTERISTICS OF THE ANGULAR SPECTRUM OF SCATTERED ELECTROMAGNETIC WAVES IN A RANDOMLY INHOMOGENEOUS ABSORPTIVE LAYER

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It is well known that absorption in randomly inhomogeneous media makes a significant influence on the statistical characteristics of multiple scattered radiation. Asymmetrical statement of a problem leads to substantial distortion of the angular (spatial) power spectrum (APS) of scattered radiation. The study of APS is of a great practical importance. This paper is devoted to the investigation of the evolution of statistical characteristics of the APS of scattered electromagnetic waves by plane absorptive nonisotropic dielectric layer with permittivity fluctuations. Source and receiver are located on different sides with respect to the layer. Analytical expressions of statistical characteristics of the angular power spectrum such as broadening and displacement of its maximum has been obtained in the ray-(optics) approximation. Theoretical investigations have shown that the behaviour of the APS depends on: the location of the source and the receiver with respect to layer, thickness of the layer, characteristic scales (longitudinal and transversal spatial scales) of random inhomogeneities and absorption in the layer. Statistical characteristics of scattered radiation were obtained for arbitrary correlation function of permittivity fluctuations. Numerical calculations of the statistical characteristics of scattered radiation have been carried out for both Gaussian nonisotropic correlation function and two-scaled Kolmogorov-Obukhov spectra. Dependences of the width and the displacement of maximum of the spatial spectrum versus both nonisotropic parameter and different non-dimensional spatial parameters (location of the source and the receiver) are illustrated in detail. The obtained results allow us to analyze transformation of the APS at various positions of the source and the receiver with respect to inhomogeneous absorptive layer. It is shown that when the condition of small-angle approximation is satisfied, for a layer having small thickness, the APS has nearly the Gaussian form despite the non-Gaussian character of the spatial spectrum of permittivity fluctuations. From the numerical simulations it follows that for a layer of a significant thickness even without absorption, strong distortion of the APS is observed at a certain location of the source and the receiver with respect to the layer; APS has strongly non-Gaussian character and maxima correspond to the allocated directions of wave propagation. Distribution of radiation along these directions is practically impossible depending on position of the source and (or) the receiver. This effect has been discovered for the first time.