Statistical characteristics of scattered high frequency radio waves in the anisotropic collision magnetized ionospheric plasma

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This paper represents incline incidence of high-frequency radio wave on the magnetized collision ionospheric plasma slab in the ray (-optics) approximation taking into account boundary conditions using the Snell's low. Fourth order dispersion equation is derived for the mean field of scattered radio waves including components of the second rank dielectric permittivity tensor of the magnetized plasma. Set of stochastic differential equations is obtained for the fluctuating electric field vector. Second order statistical moments of the phase and amplitude fluctuations of high-frequency electromagnetic waves are investigated taking into account both electron density and external magnetic field fluctuations. Polarization effects for the ordinary and extraordinary waves are taken into account. The obtained results are valid for arbitrary correlation functions of fluctuating plasma parameters in the near and far zones from a slab. The influences of both anisotropy factor and angle of inclination of prolate irregularities with respect to the external magnetic field on the statistical characteristics of scattered radio waves: Stokes parameters, broadening of the spatial spectrum of scattered radiation, displacement of its maximum, angle of arrivals in the principle and perpendicular planes are investigated analytically and numerically for both anisotropic Gaussian and power law spectral functions characterizing electron density fluctuations on different ionospheric layers. Interaction effect of waves is considered on the basis of the dispersion equation at different angles of incidence on plasma slab. Phase portraits of the correlation functions of the amplitude and phase fluctuations were constructed for different spatial parameters characterizing given problem taking into account external magnetic field fluctuations. Numerical calculations were carried out at different distances between observation points and parameters characterizing anisotropic irregularities having different characteristic spatial scales. The obtained results are of interest and will have application in satellite communication and ionospheric monitoring stimulating investigation of ionospheric irregularities.