Scattering of radio frequency waves by edge density blobs and fluctuations in tokamak plasmas*

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The density blobs and fluctuations present in the edge region of magnetic fusion devices can scatter radio frequency (RF) waves through refraction and diffraction. Using the geometric optics approximation for the waves, a Fokker-Planck equation for the refractive scattering of rays by a random distribution of blobs has been derived [1]. It is found that the scattering can diffuse the rays in space and in wave-vector space. The diffusion in space can make the rays miss their intended target region, while the diffusion in wave-vector space can broaden the wave spectrum and modify the wave damping profile. In ITER-type plasmas, it is found that spatial diffusion is important for electron cyclotron (EC) waves. For LH waves, diffusion in wave vector space is important which leads to a broadening of the current profile. The diffractive scattering of waves can lead to ``shadowing'' effects and coupling of the primary RF wave to surface waves and other plasma waves. Diffractive scattering, as opposed to refractive scattering, requires a full-wave treatment.

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