Scattering of electromagnetic waves off density inhomogeneities in the solar corona is an important process in determining both the source size and the time profile of radio bursts observed at 1 AU. Here we model the scattering process using a Fokker-Planck equation and apply this formalism to several regimes of interest. In the first regime the density fluctuations are considered quasi-static; in this case diffusion in wavevector space is dominated by angular diffusion on the surface of a constant energy sphere. In the small-angle ("pencil beam") approximation, this diffusion further occurs over a small solid angle in wavevector space, resulting in both angular broadening and propagation delays relative to unscattered photons. The second regime corresponds to a much later time, by which scattering has rendered the photon distribution near isotropic; further scattering now results in a spatial diffusion of the radiation. The third regime involves time-dependent fluctuations which result in Fermi acceleration of photons. Combined, these results provide a comprehensive theoretical framework within which to understand several important features of propagation of radio burst waves in the solar corona: emitted photons are accelerated in a relatively small inner region and then diffuse outwards to larger distances. En route, angular diffusion results both in source sizes which are substantially larger than the intrinsic source, and in observed intensity-versus-time profiles that are asymmetric, with a sharp rise and an exponential decay. Both of these features are consistent with observations of solar radio bursts.