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Propagation of radiation in fluctuating multiscale plasmas: Kinetic theory and simulations KUNWAR PAL SINGH, School of Physics, University of Sydney, NSW 2006, P.A. ROBINSON, YU. TYSHETSKIY, IVER H. CAIRNS — Propagation of radiation in plasmas with small scale fluctuations is very important in many applications, especially in the systems involving multiscale physics where plasma nonuniformities are highly prevalent. A theory of radiation propagation in a large scale plasma with small scale fluctuations is developed using a kinetic description of the radiation in terms of the probability distribution function of the radiation in space, time, and wave vector space. Large scale effects associated with the refractive index of the plasma and small scale effects such as scattering of radiation by density clumps in fluctuating plasma, spontaneous emission, damping, mode coupling, and mode conversion are included in the multiscale kinetic description of the radiation. A finite difference algorithm is developed to solve the kinetic equation governing propagation of radiation. The algorithm is tested and verified for diffusion in wave-vector space, nonuniform plasma and small scale density fluctuations. The multiscale simulations verify the main physical effects in plasma profiles that approximate those in space plasmas, and demonstrate that realistic simulations can be carried out in a feasible amount of computational time.

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