A Monte-Carlo scheme for the wave kinetic equation and the simulation of waves in a turbulent plasma

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Abstract. The wave kinetic equation [cfr., O. Maj's lecture on Friday, July 7th] can be applied to describe electron cyclotron waves in a plasma, accounting for the *average* effect of density fluctuations. The average means, on a physics level, that a wave beam is injected in a plasma for a time that is longer than the characteristic time of variation of the plasma density itself. On a mathematics level, we treat this "time average" as an "*ensemble* average" over different realizations of an opportunely defined random background.

Limiting our analysis to averaged quantities, we can overcome the usual limitations on the scale of the background variations presented by standard semiclassical methods. Moreover, the form of the equations obtained in the semiclassical limit naturally leads to the derivation of a numerical scheme for the solution based on Monte-Carlo techniques, with a considerable performance gain with respect to standard discretization methods.

In the talk, we will briefly introduce the method, then discuss the numerical scheme and its implementation in the code `WKBeam`, which allows us to simulate realistic fusion-related scenarios.