# 3D Full Wave Propagation Code for Warm Plasma

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Simulations of wave propagation in the low-frequency range are made using the three-dimensional code LEMan. This permits to study wave heating and fast ion destabilisation. This code solves a wave equation derived from the linearised Maxwell equations. Until now, all the calculations have been performed within a cold formulation. A warm model is now under development. The methodology is unchanged but the dielectric tensor has now finite temperature effects. It is calculated from the Vlasov equation but it does not take into account finite Larmor Radius terms. Nevertheless, effects in the direction parallel to the equilibrium magnetic field are retained and the parallel vector is computed exactly. This last component has a particularly simple form thanks to the Fourier decomposition in toroidal and poloidal angles.

From the previous version of LEMan, a numerical effort has been made to parallelise the code with MPI. This permits to improve the efficiency of computing and run cases needing more memory. It is particularly interesting for 3D warm model cases which require increased cpu and memory limit for the calculation of the dielectric tensor. But it is useful in the cold model, too. For instance, in the ICRF domain, you have to take a great number of Fourier modes into account when the wavelengths become small compared with the plasma dimensions.