LARGE SCALE SIMULATION OF LANGMUIR TURBULENCE USING SPECTRAL METHODSE

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Abstract:

Langmuir turbulence has been modeled with modified versions of the original Zakharov equations for a long time. These equations are usually solved for a small volume around the altitudes where parametric instabilities are triggered by HF radars, such as HAARP. Recently, Eliasson [1] proposed a new model that incorporates more physics and can be applied to the full 1D range from the ground. This system is numerically solved by using two meshes in order to reduce the computational cost considerably: one large scaled mesh for the electromagnetic field and the other small scaled for the electrostatic turbulence. In this work, we propose using spectral methods to solve the same system proposed by Eliasson. It is well known that spectral methods are exponentially convergent and in some cases achieve a comparable precision to other finite difference and finite volume approaches with much less computational cost. Furthermore, we compare the approach of using different grids to the strategy of using one grid of variable resolution. Finally, we use these results to simulate the power spectra seen by the stimulated electromagnetic emission receivers used in ionospheric heating facilities.

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References:

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