Weakly dispersive wave turbulence on the surface of a liquid in an external magnetic field

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The turbulence of capillary waves on the surface of a ferrofluid in a horizontal magnetic field is considered in the framework of a one-dimensional (1D) weakly nonlinear model. The computational data show that the spectrum of wave turbulence is divided into two parts: a low-frequency dispersionless region, where the magnetic forces dominate and a high-frequency dispersive one, in which the influence of capillary forces becomes significant. In the first region, the spectrum of the surface elevation is found to have the same power-law exponent in k and ω representations, with a value close to $-7/2$, in good agreement with the estimation obtained from the dimensional analysis of the weak turbulence spectra for pure 1D magnetic waves. At high frequencies, the computed spatial spectrum of the surface waves is close to $k^{-5/2}$ which corresponds to $\omega^{-5/3}$ in terms of the frequency. This spectrum does not coincide with the Zakharov-Filonenko spectrum obtained for pure 1D capillary waves. A possible explanation of this fact is in the influence of coherent structures (like shock waves) usually arising in weakly dispersive media.

This work is supported by Russian Science Foundation project No. 19-71-00003. E.F. thanks partial support of ANR Dysturb ANR-17-CE30-0004, and of the Simons Foundation/MPS N°651463.