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Weak compressibility of surface wave turbulence MARIJA VUCELJA, Weizmann Institute of Science, ITZHAK FOUXON, Weizmann Institute of Science, Hebrew University of Jerusalem, GREGORY FALKOVICH, Weizmann Institute of Science — Clustering of matter on the surface of lakes and pools and of oil slicks and seaweed on the sea surface is well-known empirically but there is no theory that describes it. Since surface flows are always compressible, such a theory should be based on the description of the development of density of inhomogeneities in a compressible flow. We studied the growth of small-scale inhomogeneities in the density of particles floating in weakly nonlinear small-amplitude surface waves. Despite the small amplitude, the accumulated effect of the long-time evolution may produce a strongly inhomogeneous distribution of the floaters: density fluctuations grow exponentially with a small but finite exponent. We have shown that the exponent is of sixth or higher order in wave amplitude. As a result, the inhomogeneities do not form within typical time scales of the natural environment. Thus the turbulence of surface waves is weakly compressible and alone it cannot be a realistic mechanism of the clustering of matter on liquid surfaces. However if besides waves there are also currents, the interplay of waves with currents, might be in some cases responsible for the patchiness of the floaters.

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