Turbulence generated by parametrically excited capillary waves

H. Punzmann (0), M.G. Shats (0), H. Xia (0), V. Lebedev (1), and S. Lukaschuk (2)

(0) The Australian National University, Research School of Physics and Engineering, Physics of Fluids Laboratory, Australia, (1) Landau Institute for Theoretical Physics, Moscow, Kosygina 2, 119334, Russia, (2) Department of Engineering, The University of Hull, Cottingham Road, Hull HU6 7RX, United Kingdom

We present the first experimental evidence of a modulational instability of capillary waves on the water surface. Waves are excited parametrically in a vertically shaken container. At lower excitation amplitudes a wide spectrum of discrete harmonics of the parametrically driven wave develops. The modulational instability leads to the development of a spectrally broadened sideband mode. When the spectral width of the unstable mode becomes comparable to the spacing of the discrete harmonics, broadband turbulence forms.

The analysis of the bispectra suggests that a transition from a discrete to turbulent broadband spectrum occurs via the phase-transition from the coherent to random-phase 3-wave interactions. The scaling of the broadband turbulence spectrum agrees with the one expected for weak turbulence of capillary waves.