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Discrete Wave Turbulence on Rational and Irrational Tori
ALEXANDER HRABSKI, YULIN PAN, University of Michigan — We consider the long-term dynamics of nonlinear dispersive waves in a finite domain. This configuration arises both naturally (e.g., surface waves in a finite tank) and computationally (e.g., when periodic boundary conditions are used to approximate an infinite system). While the finite domain effect on the formation of power-law wave spectra has been studied in the framework of discrete wave turbulence, the effect of the aspect ratio of the domain has remained unexplored. In this work, we study the long-term evolution of the two-dimensional MMT (Majda, Mclaughlin, Tabak) equation on both rational and irrational tori (mapped from two-dimensional planes with rational and irrational aspect ratios). It is shown that the dynamics (e.g. power-law spectra) of the two systems are remarkably different, especially at lower nonlinearity levels. The results are explained in the context of discrete nonlinear resonances, in particular by the survival of exact resonances on rational/irrational tori. We conclude by outlining the implications of these findings for other physical wave contexts.

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