Dynamics of one-dimensional supersolids

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Above the critical velocity, superfluidity breaks down and solitons or vortices are emitted periodically[1][2]. The period of the solitons or vortices emission obeys an scaling law : $T \propto |v - v_c|^{-0.5}$. Here, T is the period, v is the velocity, and v_c is the critical velocity. This scaling law is related to a saddle node bifurcation[3][4].

In our previous work[5], we showed that there exists the steady flow state of one-dimensional supersolids in the presence of an obstacle by using the Gross-Pitaevskii equation with a finite range two-body interaction. However, the dynamical properties of this system were not known well.

We investigate the breakdown dynamics of one-dimensional supersolids above a critical velocity. We show that solitons are emitted periodically, as in the case of superfluids. Moreover, we find that the period of the solitons emission obeys a power law. We will discuss the difference between superfluids and supersolids from a viewpoint of the scaling properties.

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