Burger *et al.* **Reply:** In their Comment, Wu and Niu [1] argue about the interpretation given in [2] to account for the reported experimental observation of dissipative dynamics of a Bose-Einstein condensate (BEC) in an optical lattice. They claim that the observed dissipation can be fully attributed to the dynamical instability described in [3,4] and not to Landau instability. Furthermore, they claim that in [2] simulations of the Gross-Pitaevskii equation (GPE) were used to describe the Landau instability.

As described in the paper by Wu and Niu [3], both the dynamical instability and the Landau instability may play a significant role in the dynamics of a Bose-Einstein condensate in an optical lattice. The key point is which of the two phenomena prevails in different parameter ranges.

In [2] we report simulational results from a full numerical solution of the GPE for a finite condensate moving in an optical lattice and driven by a harmonic force. All the simulation parameters have been chosen as close as possible to that of the experimental system studied in [2]. As we enter the "dissipative" regime, the GPE predictions start to be in only partial qualitative agreement with the experimental results as is evident from Fig. 3 in [2].

In particular, in this regime as reported in [2], "the density distribution of the condensate in the simulation becomes fragmented and its phase is completely randomized" (see also [5,6]) indicating the onset of a dynamical instability, while the density distribution of the real gaseous cloud in the experiment shows a different behavior. In the experiment the atomic cloud breaks up into two components. Their observed dynamical behavior is consistent with the interpretation of a superfluid central part (with a high density and a strongly peaked momentum distribution) and a second part (with a much broader spatial distribution and a Gaussian distribution in the direction perpendicular to the induced movement) which undergoes retardation. Incidentally, this observation tells us that the inhomogeneity of the cloud is important (see the discussion given in [2] and the inset in Fig. 4 there). This behavior is not seen in the time-dependent GPE simulations.

From this observation we deduce that the real system cannot be fully (and quantitatively) described in the framework of the GPE, as this mean-field theory cannot account for energy dissipation processes. On the other hand, we expect a BEC to have a "Landau instability" as is seen also in other experiments [7].

In the main body of Fig. 4 in [2] we report the measured fraction N_s/N of the total number of atoms in the cloud that remains superfluid in this regime as a function of the velocity v with which it passes through the bottom of the harmonic bowl. This experimental feature can be quantitatively understood as a gradual destruction of superfluidity via emission of sound waves in a periodically modulated inhomogeneous medium. This model predicts a specific simple form for the function N_s/N versus v, containing a single parameter which represents the compressibility of the cloud and is independently calculated from the physical parameters of the experimental sample to yield the prediction that superfluidity should completely disappear when v reaches the value 5.2 mm/s. In regard to the experimental data, the predicted functional form of N_s/N fits them very well and the fit yields a value of the maximum allowed velocity which is equal to 5.3 ± 0.5 mm/s.

In summary, a dynamical instability coming from the GPE may play a role in the dynamics of a condensate moving through an optical lattice but cannot describe the mechanisms of energy dissipation that can be important. As a matter of fact, the experimental observations reported in Fig. 4 of [2] agree well with the interpretation that phonon emission from a Landau instability takes place in our experiment. The Landau instability advocated in [2] is not an alternative explanation with respect to the dynamical instability but a separate phenomenon which fully accounts for our observations.

Of course, we cannot exclude that in other regimes of system parameters (as, for example, lower atom number and lower potential depth that in any case not only enter in the determination of the sample density but also in the scaling between the BEC chemical potential and the optical wells depth [6]) and for other applied forces the dynamical instability may describe the behavior of the system.

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