Phase ordering kinetics of a nonequilibrium exciton-polariton condensate

Michał Kulczykowski[1] and Michał Matuszewski[1]

[1]*Instytut Fizyki Polskiej Akademii Nauk, Aleja Lotników 32/46, 02-668 Warsaw, Poland*

We investigate the process of coarsening via annihilation of vortex-antivortex pairs, following the quench to the condensate phase in a nonresonantly pumped polariton system. We analyze in detail two distinct cases, corresponding to shorter and longer polariton lifetime. In the case of a short polariton lifetime, we find that the late-time dynamics is a clean example of universal phase ordering kinetics, characterized by scaling of correlation functions in time. The evolution of the characteristic length scale $L(t)$ is the same as for the two-dimensional XY model, described by a power law with the dynamical exponent $z \approx 2$ and a logarithmic correction. In contrast, in the case of a long polariton lifetime, we obtain the exponent $z \approx 1$, which agrees with previous studies of conservative superfluids.
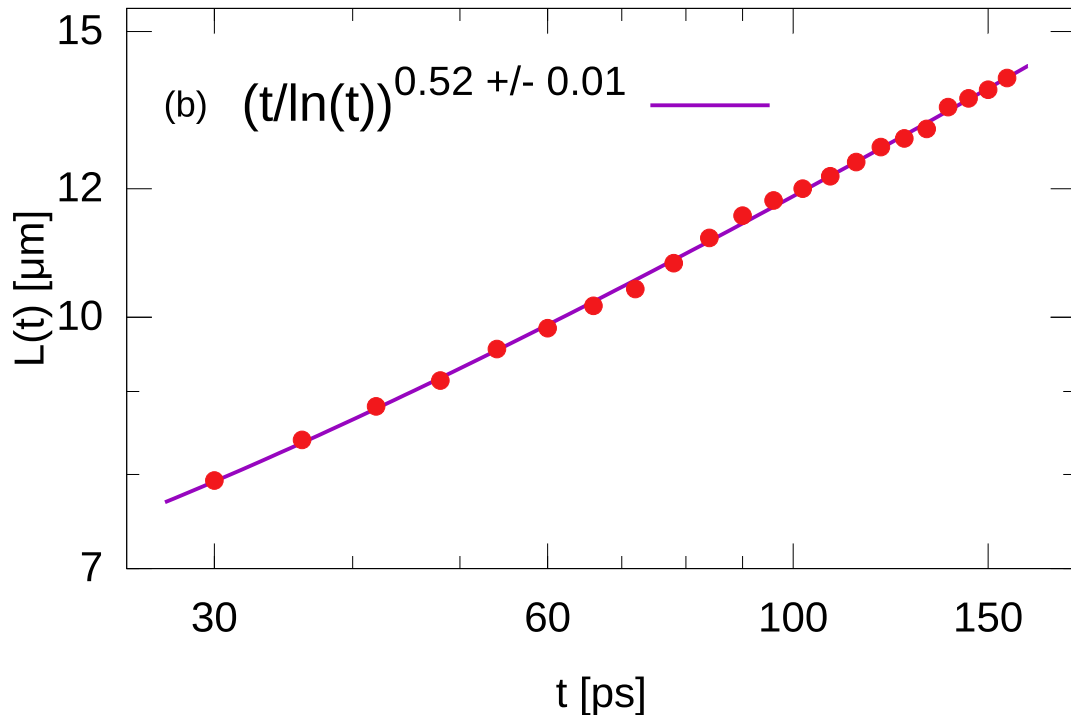
Figure 1: Case with pure phase ordering. In this case the length scale follows the universal scaling law for vector systems in two dimensions with nonconserved order parameter.