INTERPLAY BETWEEN KIBBLE-ZUREK MECHANISM AND INVERSE FARADAY EFFECT FOR ABRIKOSOV VORTEX GENERATION

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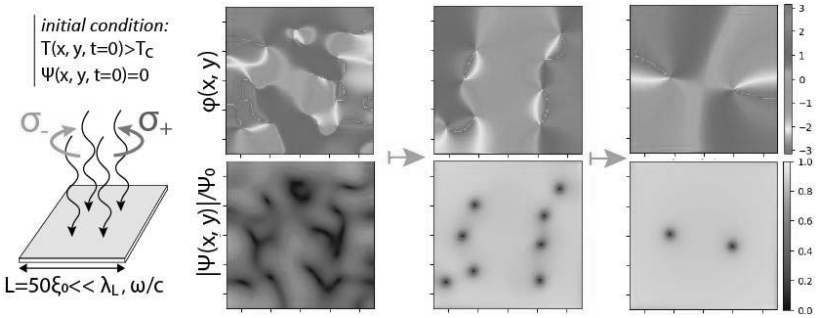
We found that the circularly polarized light can affect the Kibble-Zurek mechanism of the vortex-antivortex pair formation in a superconductor driven through the T_c point and expels the vortices of a certain polarity depending on the polarization sign. As a consequence one can create a nonzero vorticity and corresponding magnetic moment in a superconducting system using the polarized light realizing, thus, the Inverse Faraday Effect (IFE). We present the results of numerical simulation of the vortex generation due to the rapid thermal quench in a quasi-two dimensional superconductor exposed to the circularly polarized external electromagnetic field. Our calculations are based on the time dependent Ginzburg-Landau (TDGL) equation and we demonstrate that the described effect is related to the imaginary part of the relaxation time in the TDGL equation. This is in accordance with the recent theoretical studies of the IFE in superconductors [Mironov et al PRL 2021].



Time evolution of the modulus and phase of the order parameter Ψ(x,y,t) in a two-dimensional superconductor exposed to an external polarized light with the frequency ω. At t=0 the order parameter is equal to zero at each point, so superconductivity is recovered in the presence of an external homogeneous electromagnetic field with σ- polarization. The sign of polarization determines the sign of vortices remaining in the superconductor.