Modulation of the superconducting properties of an ultrathin Pb island

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To date, plenty of measurements conducted on surface-confined superconducting Pb/Si(111) nano-islands have revealed that both the critical temperature and the gap diminish with decreasing film thickness. Also, due to the confinement in nano-islands, stable vortex arrangements, other than the triangular lattice, can be obtained [1-4]. Recent experimental data show how the confinement affects the vortex arrangement in Pb/Si(111) nano-islands of different geometry [5], that even can lead to formation of a giant (multi-quanta) vortex, or nontrivial vortex configurations in cases where the thickness of the island varies inside the sample [6].

We use advanced Ginzburg-Landau simulations (using Antwerp GLACE code) to study the effects emerging in vortex matter in Pb islands by modulation of material properties through in situ tailoring of the superconducting condensate. The spatially modulated quantities include the mean-free path, thickness, critical temperature, each of which lead to non-trivial changes in the behavior of the superconducting condensate and thereby the vortices as well.

References

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