# ABRIKOSOV FLUXONICS IN WASHBOARD NANOLANDSCAPES

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Abrikosov fluxonics [1], a domain of science and engineering at the interface of superconductivity research and nanotechnology [2], is concerned with the study of the properties and dynamics of Abrikosov vortices in nanopatterned superconductors, with particular focus on their confinement, manipulation, and exploitation for emerging functionalities. Vortex pinning, guided vortex motion, and the ratchet effect are three main fluxonic "tools" which allow for the dynamical (pinned or moving), the directional (angle-dependent), and the orientational (current polarity-sensitive) control of the fluxons, respectively [3,4].

In this talk a set of original experimental results [5-10] on the vortex dynamics in the presence of periodic pinning potentials in Nb thin films is presented. The consideration is limited to one particular type of artificial pinning structures – directly written nanolandscapes of the washboard type, which are fabricated by focused ion beam milling and focused electron beam induced deposition. Thanks to the periodicity of the vortex lattice, several groups of effects emerge when the vortices move in a periodic pinning landscape: (i) Spatial commensurability of the location of vortices with the underlying pinning nanolandscape leads to a reduction of the dc resistance and the microwave loss at the so-called matching fields [5,6]. (ii) Temporal synchronization of the displacement of vortices with the number of pinning sites visited during one half ac cycle manifests itself as Shapiro steps in the current-voltage curves [7,8]. (iii) Delocalization of vortices oscillating under the action of a high-frequency ac drive can be tuned by a superimposed dc bias [9,10]. The reported results are, in particular, relevant for the development of novel fluxonic devices, the reduction of the microwave loss in superconducting planar transmission lines and the synthesis of quantized power absorption levels in fluxonic nano-metamaterials.

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