Large oscillations of the magnetoresistance in nano-patterned $La_{1.84}Sr_{0.16}CuO_4$ superconducting films

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We report the results of magnetoresistance measurements in a unique network of non-interacting $La_{1.84}Sr_{0.16}CuO_4$ nano-loops [1].The network magnetoresistance exhibits oscillations with field periodicity ϕ_0/A, where $\phi_0 = h/2e$ is the flux quantum and A is the area of a single loop. Remarkably, the oscillation amplitude is larger by two orders of magnitude than that expected from the Little-Parks effect. We argue that unlike the Little-Parks oscillations, which originate from periodic changes in the superconducting transition temperature, the oscillations we observe are caused by periodic changes in the interaction between thermally-excited moving vortices and the oscillating persistent current induced in the loops. Despite the enhanced amplitude of these oscillations, we have not detected oscillations with a period of h/e, as recently predicted for nanoscale loops of superconductors with d-wave symmetry, or with a period of $h/4e$, as predicted for superconductors that exhibit stripes.

[1]I. Sochnikov et al., Nature Nano. **5**, 516 (2010); I. Sochnikov et al., PRB **82**, 094513 (2010)