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Review

Magnetic Recording of Superconducting States

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Abstract: Local polarization of magnetic materials has become a well-known and widely used method for storing binary information. Numerous applications in our daily life such as credit cards, computer hard drives, and the popular magnetic drawing board toy, rely on this principle. In this work, we review the recent advances on the magnetic recording of inhomogeneous magnetic landscapes produced by superconducting films. We summarize the current compelling experimental evidence showing that magnetic recording can be applied for imprinting in a soft magnetic layer the flux trajectory taking place in a superconducting layer at cryogenic temperatures. This approach enables the *ex-situ* observation at room temperature of the imprinted magnetic flux landscape obtained below the critical temperature of the superconducting state. The undeniable appeal of the proposed technique lies in its simplicity and the potential to improve the spatial resolution, possibly down to the scale of a few vortices.

Keywords: superconductor-ferromagnet hybrids; magnetic tweezers; superconducting devices

1. Introduction

Superconductivity and magnetic order are two macroscopic quantum coherent states of antagonistic nature, hence, leading to competing ground states [1–3]. This competition manifests itself in the scarceness of compounds exhibiting coexistence between long-range magnetic order and superconductivity [4–8], and is also reflected in the phase diagram of cuprate superconductors where an antiferromagnetic phase develops at the expense of the superconducting phase [9,10]. The preservation of both states can be achieved by renouncing intimate coexistence and physically separating them in different layers. Yet in this case, profound modifications of the superconducting state are observed at the interface between the two materials. Even if an insulating material prevents such an interface, a mutual magnetic interaction persists through their stray fields [11]. The resulting