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Electrostatic manipulation of magnetic flux quanta at the nanoscale ARNAUD CRASSOUS, ROZENN BERNARD, STEPHANE FUSIL, KARIM BOUZEHOUANE, JAVIER BRIATICO, MANUEL BIBES, AGNES BARTHELEMY, JAVIER VILLEGAS, Unite Mixte de Physique CNRS/THALES — The electrostatic tuning of physical properties in materials offers significant potential in a large variety of systems. For example, the application of an electric field allows depressing or enhancing superconductivity in certain oxides. Using heterostructures that combine a large-polarization ferroelectric (BiFeO3) and a high-temperature superconductor (YBa2Cu3O7-x), we demonstrate here the nanoscale modulation of the superconducting condensate via ferroelectric field effects [1]. The ability to design the ferroelectric domain structure at will enables us to create nanoscale "patterns" of normal regions within the superconductor, in a reversible and modifiable way. This produces an energy landscape for magnetic flux quanta and, in turn, couples the local polarization in the ferroelectric to the local magnetic induction in the superconductor. This new form of magnetoelectric coupling allows the electrostatic manipulation of magnetic flux quanta.

[1] A. Crassous et al., Phys. Rev. Lett. in press (2011)

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