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【125】 Engineering Ultradense Vortex Pinning Arrays by Focused He Ion Beam Irradiation In Copper-Oxide Superconductors

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Exploring strongly interacting engineered vortex patterns in copper-oxide superconductors requires vortex distances smaller than the London penetration depth. With the focused beam of a helium ion microscope, we fabricate pinning sites with spacings down to 40 nm in $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ thin films and investigate vortex commensurability effects at unprecedented high magnetic fields at the order of 1 T. In quasi-kagomé tilings, magnetic caging of vortices is observed and confirmed by molecular dynamic simulations of vortex motion. These findings open the path for the realization of even more complex structures and intriguing possibilities for the manipulation of vortices in high-temperature superconductors.

Primary author: AICHNER, Bernd (Faculty of Physics, University of Vienna)

Co-authors: KARRER, Max (Physikalisches Institut and Center for Quantum Science (CQ) in LISA+, Universität Tübingen); WURSTER, Katja (Physikalisches Institut and Center for Quantum Science (CQ) in LISA+, Universität Tübingen); BACKMEISTER, Lucas (Faculty of Physics, University of Vienna); MISKO, Vyacheslav (Department of Physics, Universiteit Antwerpen; Theoretical Quantum Physics Laboratory, RIKEN Cluster for Pioneering Research, Wako-shi, Saitama, Japan); DOSMAILOV, Meirzhan (Institute of Applied Physics, Johannes Kepler University Linz); PEDARNIG, Johannes (Institute of Applied Physics, Johannes Kepler University Linz); NORI, Franco (Theoretical Quantum Physics Laboratory, RIKEN Cluster for Pioneering Research, Wako-shi, Saitama, Japan; Physics Department, University of Michigan); KLEINER, Reinhold (Physikalisches Institut and Center for Quantum Science (CQ) in LISA+, Universität Tübingen); GOLDOBIN, Edward (Physikalisches Institut and Center for Quantum Science (CQ) in LISA+, Universität Tübingen); KOELLE, Dieter (Physikalisches Institut and Center for Quantum Science (CQ) in LISA+, Universität Tübingen); LANG, Wolfgang (Faculty of Physics, University of Vienna)

Presenter: AICHNER, Bernd (Faculty of Physics, University of Vienna)

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