# 南方科技大学

# 优秀硕士学位论文代表性成果证明材料

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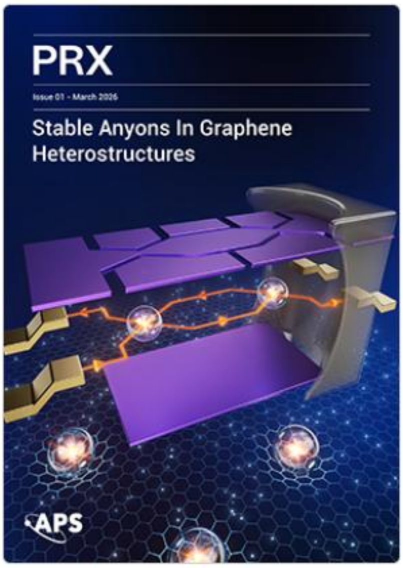


Issue 1

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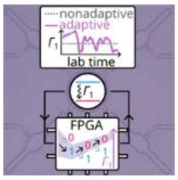
## [Real-Time Adaptive Tracking of Fluctuating Relaxation Rates in Superconducting Qubits]

Fabrizio Berritta, Jacob Benestad, Jan A. Krzywda, Oswin Krause, Malthe A. Marciniak, Svend Krøjer, Christopher W. Warren, Emil Hogedal, Andreas Nylander, Irshad Ahmad, Amr Osman, Janka Biznárová, Marcus Rommel, Anita Fadavi Roudsari, Jonas Bylander, Giovanna Tancredi, Jeroen Danon, Jacob Hastrup, Ferdinand Kuemmeth, and Morten Kjaergaard

Phys. Rev. X **16**, 011025 (2026) - Published 13 February, 2026

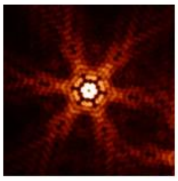



A field-programmable-gate-array-based Bayesian protocol is developed to track qubit relaxation fluctuations in real time, revealing environmental noise dynamics 10 000 times faster than previously reported.

## Microscopic Fingerprint of Chiral Superconductivity

Xuefeng Wu, Xuan Hao, Zhuo Chen, Yuchang Cai, Minghao Wu, Congrun Chen, Kedong Wang, Fangfei Ming, Steven Johnston, Rui-Xing Zhang, and Hanno H. Weitering

Phys. Rev. X **16**, 011026 (2026) - Published 17 February, 2026

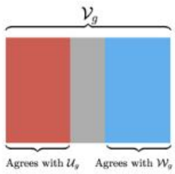


Direct imaging of electron scattering from atomic defects in a tin monatomic layer provides a clear microscopic signature of chiral superconductivity.

## Anomalies of Global Symmetries on the Lattice

Yi-Ting Tu, David M. Long, and Dominic V. Else

Phys. Rev. X **16**, 011027 (2026) - Published 18 February, 2026




A rigorous framework is established to define and classify lattice anomalies, revealing unique "IR-trivial" invariants that constrain the physics of many-body-localized systems and more beyond the reach of standard field theories.

## Reshaping the Quantum Arrow of Time

Luis Pedro García-Pintos, Yi-Kai Liu, and Alexey V. Gorshkov

Phys. Rev. X **16**, 011028 (2026) - Published 19 February, 2026

# Microscopic Fingerprint of Chiral Superconductivity

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Chiral superconductors have long been theorized to break time-reversal symmetry and support exotic topological features such as Majorana modes and spontaneous edge currents, promising ingredients for quantum technologies. Although several unconventional superconductors may exhibit time-reversal symmetry breaking, clear microscopic evidence of chiral pairing has remained out of reach. In this work, we demonstrate direct real-space signatures of chiral superconductivity in a single atomic layer of tin on Si(111). Using quasiparticle interference imaging, we detected symmetry-locked nodal and antinodal points in the Bogoliubov quasiparticle wave function, tightly bound to atomic point defects in the tin lattice. These nodal features, along with their surrounding texture, form a distinct real-space pattern exhibiting a clear and exclusive hallmark of chiral superconductivity. Our findings, reinforced by analytical theory and numerical simulations, offer unambiguous evidence of chiral pairing in a two-dimensional material.

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Subject Areas: Condensed Matter Physics, Strongly Correlated Materials, Superconductivity

Chiral superconductivity is a long-sought phase of matter in which Cooper pairs acquire a well-defined handedness, spontaneously breaking time-reversal symmetry. These states are predicted to host Majorana bound states, protected edge modes, and exotic vortices—hallmarks of topological superconductivity with potential applications in quantum information processing [1–3]. Despite extensive efforts, definitive microscopic evidence for chiral pairing has remained elusive. Leading candidate materials, including $Sr_2RuO_4$ [4–8], $UTe_2$ [9–11], and a range of heavy fermions [12,13] and engineered platforms [14–17], exhibit signatures of time-reversal symmetry breaking but lack unambiguous confirmation of chiral phase winding.

Quasiparticle interference (QPI) imaging using scanning tunneling microscopy (STM) is a powerful technique for probing superconducting pairing symmetries. In systems such as $NbSe_2$ [18], Fe(Se,Te) [19,20], and the cuprate superconductors [21], QPI has provided critical insights into the momentum dependence of the superconducting gap, coherence factors, and the sign structure of the order parameter. However, interpreting QPI patterns remains challenging, especially in multiband systems, where analysis often requires input from angle-resolved photoemission spectroscopy (ARPES) data and theoretical modeling [22–24]. Further complicating interpretation is the often-unknown nature and range of the scattering centers and tunneling pathways [25], which can obscure the connection between observed QPI features and the underlying pairing symmetry.

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