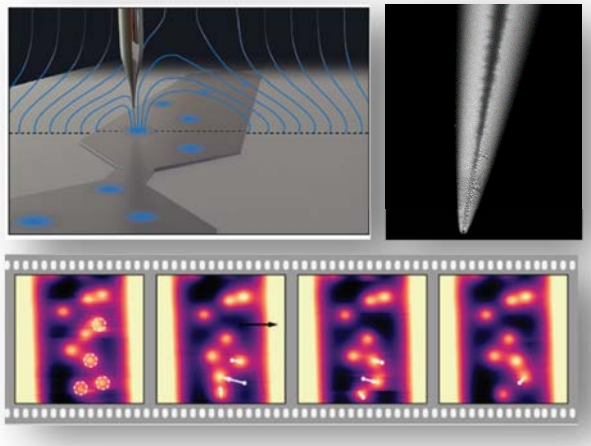
POGGIO LAB

Nano-mechanics, Nano-magnetism, Nano-imaging



Ph.D. Position Available

Department of Physics
University of Basel

We seek a talented and ambitious **Ph.D. Student** interested in mesoscopic magnetic imaging experiments based on scanning nanometer-scale superconducting quantum interference devices (SQUIDs). Building on the pioneering work of the Zeldov group (Weizmann Institute) [1], we now produce and employ state-of-the-art SQUID-on-tip (SOT) as magnetic and thermal scanning probes in our lab in Basel [2,3]. These devices, which feature a nanometer-scale SQUID on the apex of a sharp scanning probe tip, have magnetic field sensitivities down to 5 $nT/Hz^{1/2}$ [1], spatial resolutions better than 50 nm, and unmatched thermal sensitivities down to 1 $\mu K/Hz^{1/2}$ [4].

With such exquisite resolution and sensitivity, we plan to study the recently discovered correlated states in twisted bilayer graphene and other van der Waals (vdW) materials. The manifestations of these states range from superconductivity, to highly insulating states, to potentially magnetic states. The fragility and sensitivity of the observed states to inhomogeneities has limited their macroscopic manifestation and complicates conventional transport or magnetization measurements, which integrate over an entire sample. Sensitive nanoscale imaging of these systems is urgently required to probe their local properties.

The ability to map magnetic field and dissipation sensitively and on the nanometer-scale overcomes ensemble or spatial inhomogeneity in systems ranging from arrays of nanometer-scale magnets, to superconducting thin films, to strongly correlated states in vdW heterostructures. Local imaging of nanometer-scale magnetization [2], local Meissner currents [5], or current in edge-states [6] is the key to unraveling the microscopic mechanisms behind a wealth of new and poorly understood condensed matter phenomena.

1. Finkler et al., *Nano Lett.* **10**, 1046 (2010); Vasyukov et al., *Nat. Nanotechnol.* **8**, 639 (2013).
2. Vasyukov et al., *Nano Lett.* **18**, 964 (2018)
3. Ceccarelli et al., *arXiv*:1907.05110 (2019).
4. Halbertal et al., *Nature* **539**, 407 (2016); Halbertal et al., *Science* **358**, 6368 (2017).
5. Embon et al., *Nat. Commun.* **8**, 85 (2017).
6. Marguerite et al., *arXiv*:1907.08973 (2019); Uri et al., *arXiv*:1908.02466 (2019); Uri et al., *arXiv*:1908.04595 (2019).

The Department of Physics at the University of Basel offers a stimulating and collaborative environment with internationally recognized research groups active in both experimental and theoretical condensed matter physics. Our group is part of the **Swiss Nanoscience Institute** (nanoscience.ch) and the **NCCR: Quantum Science and Technology (QSIT)** (nccr-qsit.ethz.ch). More information is available at poggiolab.unibas.ch and www.physik.unibas.ch.

Candidates with previous experimental physics or scanning probe microscopy experience are preferred. A Masters in physics or a related field is required. Applications should include the candidate's CV, copies of his/her diplomas, and 2 letters of reference. **Applications should be sent directly to Prof. Poggio (martino.poggio@unibas.ch).**

poggiolab.unibas.ch www.physik.unibas.ch nanoscience.ch/en/research/phd-program

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Department of Physics
University of Basel
Klingelbergstrasse 82
4056 Basel, Switzerland

CONTACT

poggiolab.unibas.ch
martino.poggio@unibas.ch
Tel: +41 61 207 37 61
Fax: +41 61 207 37 84

PROF. MARTINO POGGIO

ORCID: 0000-0002-5327-051X
ResearcherID: B-5821-2008
Google Scholar: Martino Poggio
arXiv: poggio_m_1

University of Basel | SNI Swiss Nanoscience Institute | FNSNF | QSIT Quantum Science and Technology, National Centre of Competence in Research