Opportunity of a co-tutored PhD fellowship at the IFW Leibniz Institute of Dresden in synergy with the QTLab at UNINA (starting from January-February 2026)

We are searching for a candidate for a PhD position on the topic "Cuprate twisted structures in superconducting quantum circuits" extended by another 2 years upon a successful mid-term evaluation. The salary is based upon the TV-L rules (E13; 65%).

Your profile: We are looking for a highly motivated and team-oriented student, who holds a Master degree in physics or engineering or quantum science and technology. Basic knowledge in Quantum Science and Superconducting technology is welcome. The successful candidate is enthusiast about fundamental science, highly ambitious and a good team-player. Good communication skills in written and spoken English are required.

Project description:

High temperature superconducting complex oxides ($La_{2-x}Sr_xCuO_4$, $YBa_2Cu_3O_{7-x}$, $Bi_2Sr_2CaCu_2O_{8+x}$) are oxygen-rich and electronically heterogeneous, forming a landscape of "puddles." [1,2], which make them quite challenging to control in modern electronics. Interest now centres less on nitrogen-range Tc and more on this unparalleled, still-mysterious electronic state. Three decades of materials progress have clarified both limitations and enormous potential of those superconducting quantum materials for emergent electronics. In synergy with the QTLab in Naples, the student will work in Dresden at the fabrication facilities of the Superpuddles lab already present. The student will advance the experimental control of 2.5 dimensional van der Waals heterostructure with innovative design and tackling key experimental challenges [5,6] for novel superconducting quantum technologies (see Figure) both in the realm of electronics and photonics.

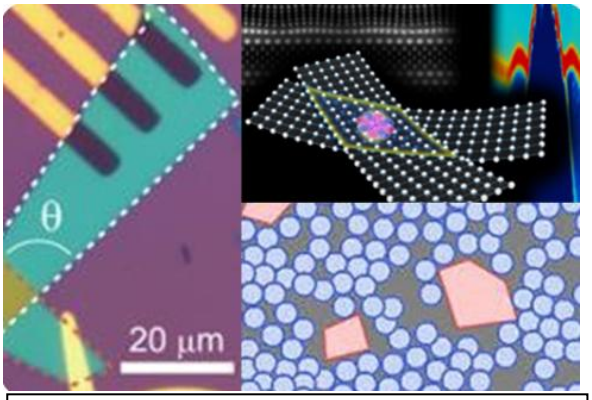

Figure : (left) An optical image of a cuprate twisted heterostructures. (upper right) A sketch of a resulting emerging new superconducting order parameter at the interface by design of the artificial twisted cuprate lattice. (bottom right). A sketch of the multicomponent electronic complexity of a high temperature cuprate superconductors.

References

[1] Poccia, Nicola, et al. "Evolution and control of oxygen order in a cuprate superconductor." *Nature materials* 10 (2011) 733-736.

[2] Fratini, Michela, NP, et al. "Scale-free structural organization of oxygen interstitials in La2CuO4+ y." *Nature* 466 (2010) 841-844.

[3] Zhao, SY Frank, NP, et al. "Time-reversal symmetry breaking superconductivity between twisted cuprate superconductors." *Science* 382 (2023) 1422-1427.

[4] Martini, Mickey, NP, et al. "Twisted cuprate van der Waals heterostructures with controlled Josephson coupling." *Materials Today* 67 (2023) 106-112.

[5] Confalone, Tommaso, NP, et al. "Cuprate Twistronics for Quantum Hardware." *Advanced Quantum Technologies* (2025) 2500203.

[6] Confalone, Tommaso, NP, et al. "Challenges in the electrical engineering of cuprate twistronics." *Nature Reviews Electrical Engineering* 2 (2025) 73-74.

If you are interested, write directly to:

Prof. Nicola Poccia[1,2]

[1]*Department of Physics, University of Naples Federico II, Via Cinthia 21, Naples 80125, Italy*
[2]*Leibniz Institute for Solid State and Materials Research Dresden, Helmholtzstr. 20, 01069 Dresden, Germany*
nicola.poccia@unina.it ; n.poccia@ifw-dresden.de
web: https://www.qtlab.unina.it/