

Open PhD position:

Visualizing the emergence of high-temperature superconductivity using the spin Hall effect

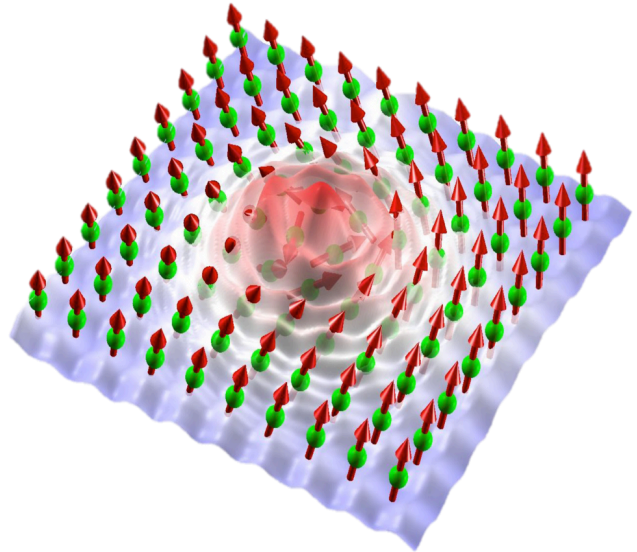
Allan lab, Leiden Institute of Physics

We are a research group at Leiden University with the overarching goal of understanding quantum materials, including unconventional superconductors, quantum-critical compounds, strange metals, and topological materials. We are currently looking for new group members with passion, talent, and grit!

Our group recently discovered that much of the iconic phenomenology of cuprate high-temperature superconductors is common to another lightly doped Mott insulators (Battisti & Bastiaans *et al.*, Nature Physics, AOP), revealing the universality of pseudogap and stripy order.

This PhD project aims to go a step beyond that, and understand the vanishing of static spin order during melting process of the Mott phase. To this end, we will develop a novel atomic probe to visualize the spin textures of these materials, based on the *Spin Hall Effect*.

This effect describes the materialization of a spin current from a perpendicular charge current in certain materials. Predicted in 1971 and measured in 2004, it immediately gathered interest for its potential use in spintronic devices. We believe that the true potential of SHE might be in its use as a local sensor – enabling us to study one of the persistent basic science question of the last few decades. The successful candidate will develop novel conduct measurements using STM, work on data analysis, and be involved in the development of new projects and instrumentation. He/she will have her/his own project (starting with the investigation of the melting Mott phase), but will be part of a team and help on other projects as well.



Additional information (see also allanlab.org):

➤ *Location:* We are a small, dynamic group, currently consisting of three PhD students and the PI. We are located at Leiden University, the birthplace of superconductivity and home to Kamerlingh Onnes, Lorentz, Huygens, Einstein, de Sitter, and others (see e.g. [the wall of signatures from Ehrenfest lecturers](#)). We exchange ideas with our neighbors from [Quantum Matter & Optics](#) as well as with the colleagues from our [world-class theory section](#). The successful candidate will be part of the Casimir Graduate School (together with TU Delft) with opportunities to take classes if desired.

➤ *Timeline:* We start reviewing applications immediately and until the position is filled (we'll mention this on allanlab.org). The starting date is flexible, and the PhD program in the Netherlands takes 4 years.

➤ *Application:* Please send inquiries / applications to allan@physics.leidenuniv.nl with the reference 'Application PhD'. Attach a motivation letter (max one page) on why you would like to join our group and about your research interests. Also attach a CV, including information about the grades you had as an undergraduate. No need for certificates at this point.