Martino Poggio studies nanowires

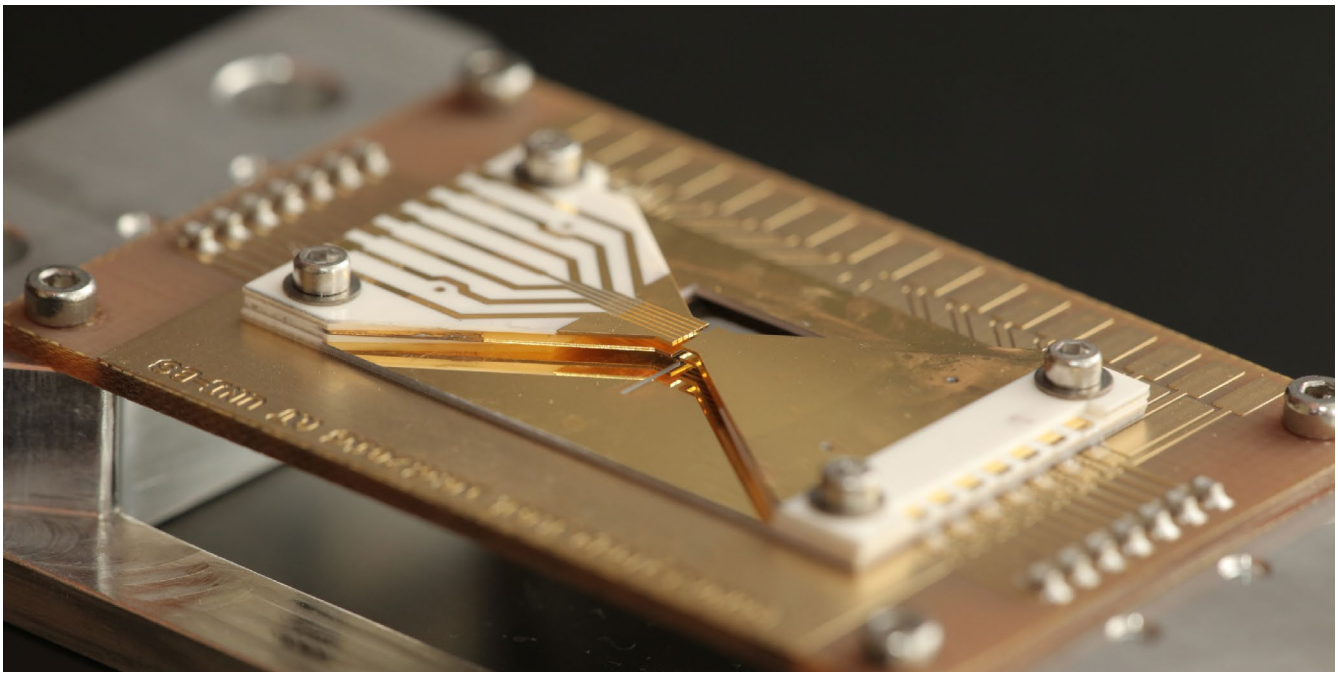
These tiny wires with special properties have a variety of potential applications

Argovia Professor Martino Poggio, from the Department of Physics at the University of Basel, leads a team studying nanowires that are suitable for a wide range of applications. In 2018, the group published findings relating to ferromagnetic nanowires that could be used to store data. A collaboration with Professor Stefan Willitsch also led to the first publication about an innovative line of research in which ultracold ions are coupled with nanowires. In a further highlight, the Poggio team organized a workshop as part of a Switzerland-wide research network that studies so-called “skyrmions”.

“The SNI is the ideal plattform for interdisciplinary research projects.”

Argovia-Professor Martino Poggio, Department of Physics, University of Basel

Simon Philipp and Martino Poggio work on so-called “skyrmions” and are engaged in a Sinergia projekt.



This set-up is used to couple ultracold ions with a nanowire. (Image: Panagiotis Fountas)

Ferromagnetic nanowires as data storage

For many years, Martino Poggio's research has focused on the potential applications of nanowires. These long, thin crystals with almost defect-free crystal lattices have an enormous surface area relative to their volume, as well as a very low mass, making them ideal for use as sensitive sensors of electric and magnetic fields. Poggio's group also studies ferromagnetic nanowires, which are mooted as a potential data storage medium of the future. In a 2018 publication in "Physical Review B", the team was able to show how magnetization behaves in the outer surfaces, corners and edges of a nanowire and how it can be reversed. The latter is a basic prerequisite for applying these magnetic structures to data storage.

Magnetic vortexes for storing data

In the future, new types of data storage could also be created using "skyrmions" – magnetic vortexes that exhibit particle-like behavior. As well as being highly resistant to external influences, skyrmions are very small and can be modified by electric fields – all factors that make them good candidates for applications in compact data storage. With a view to identifying and manufacturing new types of skyrmion-containing materials that are suitable for technical applications, a Sinergia project has been supported by the Swiss National Science Foundation (SNSF) since 2017. Martino Poggio is one of four project leaders in this Swiss research network, which was launched by Professor Dirk Grundler (EPF Lausanne).

In November 2018, participating doctoral students and scientists from the University of Basel, the Paul Scherrer Institute (PSI), and EPF Lausanne attended a workshop in Basel that was initiated and organized by Simon Philipp, a doctoral student working at the Poggio lab. "Everyone involved felt it was a successful event that brought the network closer together. In addition, the two talks by the leading experts on the subject of nanoscale imaging of magnetic materials, Professor Hans Hug (Empa) and Professor Dieter Kölle (University of Tübingen), provided all of us with some valuable insights," says Martino Poggio.

Coupling with ultracold ions

Since 2015, Martino Poggio and Stefan Willitsch, from the Department of Chemistry at the University of Basel, have been jointly supervising a doctoral dissertation at the SNI PhD School on the coupling of nanowires with individual ultracold ions. The two scientists launched this interdisciplinary project both in order to control individual ultracold ions via a nanowire and also to enable the reverse: influencing a nanowire via an ultracold ion. In 2018, Panagiotis Fountas – the doctoral student carrying out the work – co-authored an initial paper with Martino Poggio and Stefan Willitsch describing simulations of the planned experiments. These simulations showed that it is theoretically possible to couple the tiny ion with relatively large nanowires.

The scientists want to use their forthcoming experiments to combine two quantum mechanical systems and thereby to create a new hybrid system that offers new insights into the boundary between quantum mechanics and classical physics. Martino Poggio finds one aspect of the study particularly fascinating: "Theoretically, the current simulations show that an ultracold ion could be used to place a mechanical nanowire with a length of a few hundred nanometers into a quantum mechanical state and to study decoherence effects."