ETH zürich

Press Release

ERC Synergy Grants

Outstanding synergies in quantum research

Zurich, 5 November 2020

Two research projects with ETH Zurich involvement have been awarded one of the highly coveted ERC Synergy Grants. These EU grants aim to promote pioneering research that is only possible through the synergy of several teams. More than EUR 26 million will now be made available for the two projects.

As basic research continues to advance, the questions involved are becoming increasingly complex. In order to deal with this, the boundaries between the disciplines must be crossed, and expertise and resources from various fields combined. The European Research Council (ERC) launched the Synergy Grant in 2012 to promote projects that make particularly effective and innovative use of synergies to investigate pressing research questions. Two to four research groups must be involved in the projects. The ERC announced today that it would be awarding a Synergy Grant worth a total of EUR 26.6 million to two projects with ETH Zurich involvement, EUR 11.8 million of which will go to ETH Zurich. Both projects focus on the area of quantum research. While ETH professors Lukas Novotny and Romain Quidant are attempting with their Q-Xtreme project to move a particularly large object into a state of quantum superposition, the Quantropy project, with the involvement of ETH professor Klaus Ensslin, is developing innovative measurement procedures in order to better understand complex correlated quantum states in solid state systems. Synergy Grants have been awarded to 34 research projects this year, with funding amounting to a total of about EUR 350 million.

Relationships with Europe as a success factor
ETH Zurich has already done well this year in terms of research funding from the ERC, following its announcement in September that it intended to support 12 ETH projects in the category of Starting Grants. Two Advanced Grants were also awarded. “These awards are not only an honour, they also serve as a reminder of how fundamental our European relationships are,” emphasises Detlef Günther, Vice President for Research at ETH. “It’s more important than ever that Europe works more closely together in research. We can only maintain this high standard if we are able to exchange and make

use of expertise and resources as freely as possible. It’s essential that Switzerland can continue to participate in the European Research Programme beyond 2020 – with full association,” says Günther. The research programme “Horizon 2020” comes to an end this year, and it remains to be seen whether and in what form Switzerland will be involved in the successor programme “Horizon Europe”.

The Projects at a glance
In a common metal, electrons move largely independently of each other. But when they interact in a more complex material, fascinating and often technologically interesting effects appear. Well-known examples are ferromagnetism or superconductivity. In addition, there is a growing number of predictions for novel states in which interacting electrons exhibit properties that contradict intuition on the one hand and are technologically promising on the other. These effects include, for example, Majorana fermions, which in a sense consist of half an electron and, when detected, reveal where they were before.
Conventional measurement methods often do not provide clear results for such "exotic" effects. Klaus Ensslin from the ETH Laboratory for Solid State Physics, together with Frédéric Pierre from the Université Paris-Saclay, Joshua Folk from the University of British Columbia in Vancouver and Yigal Meir from Ben-Gurion University in Israel, therefore wants to develop fundamentally different measurement methods in the ERC-Synergy project Quantropy. To this end, the team will build on thermodynamic measurement quantities, in particular entropy. With this they will explore how to better understand complex correlated quantum states in solids. For Majorana fermions, for example, the new approach should clearly show whether they occur in a given material. The scientists also hope to gain new insight into other effects such as the recently discovered superconductivity in twisted graphene layers.
Laboratory for Solid State Physics website →

Quantum-physical properties manifest themselves most clearly in tiny objects: at the level of individual atoms and subunits of atoms. That is where they can be studied most easily. Compared to single atoms, nanoparticles are huge. In their ERC Synergy project Q-Xtreme, ETH professors **Lukas Novotny** and **Romain Quidant**, together with Markus Aspelmeyer and Oriol Romero-Isart from the Universities of Vienna and Innsbruck, respectively, will for the first time put a solid object with a diameter of 100 nanometres into a quantum superposition state. The scientists will use optical, electrical and magnetic forces to cause a glass sphere to behave in way as if it were simultaneously located at two different locations (or at neither of the two locations). Ultimately, they aim to create the most extreme quantum state to date – a large superposition at material densities a billion times larger than atomic gases and at 100,000 larger masses than previous experiments.
Such quantum superpositions are very fragile and are sensitive to external influences such as inertial forces and gravity. It will therefore also be possible to use the experiments to analyse the influence of gravity on quantum superpositions. In addition, they will enable the development of sensitive measuring instruments for acceleration, rotation or gravity. The experiments will be carried out at ETH Zurich and the University of Vienna; scientists from the University of Innsbruck will complement the project with theoretical work.
Photonics Laboratory website →
Nanophotonic Systems Laboratory website →

Further Information

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