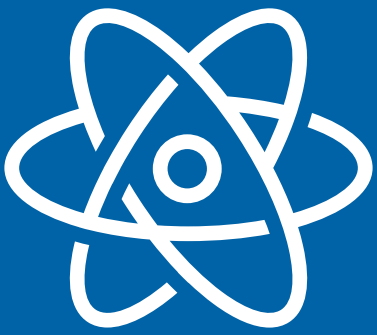
# Materials & Quantum Science



The University of Vienna invests heavily in the Materials and Quantum Science strategic priority, thereby further pooling a high number of experts in this area. New professorships were advertised in November 2018 and will be appointed in the coming one to two years. Funding is channelled through an increase in the university budget.

A significant increase in funding enables the University of Vienna to specifically invest in 73 new professorships and tenure track professorships in the coming years. It therefore sets interdisciplinary, interconnected and future-oriented priorities across faculties: Materials and Quantum Science and other socially relevant areas such as Data Science and Digital Humanities, Society and Communication, Health and Microbiome as well as Molecular Biology and Cognitive Neuroscience.

**Quantum physics**

Quantum physics is one of the theories about inanimate nature that is confirmed on a broad basis through experiments. For 120 years, it has been shaping our scientific ideas and – directly or indirectly – large areas of cutting-edge technology. Interestingly, a completely new scientific discipline has emerged from this research oriented towards basic research: quantum optics, quantum nanophysics and quantum information processing. At the Faculty of Physics, nine research groups address this topic.

The University of Vienna has become an international hub for quantum physics, embedded in a well-funded European and international funding and science landscape. Therefore, the University of Vienna participates in European projects of the Horizon 2020 programme as well as the European Quantum Flagship. Here, scientists cooperate with numerous partners like the Austrian Science Fund in the form of thematic doctoral programmes and special research programmes, and the Austrian Academy of Sciences. Two professors at the University of Vienna hold leading positions at the latter, such as at the Institute for Quantum Optics and Quantum Information.

The University of Vienna joins forces with the Chinese Academy of Sciences and the Austrian Academy of Sciences in the QUESS project, which conducts state-of-the-art research in the field of quantum encryption.

On a national level, the University cooperates with the Vienna Center for Quantum Science and Technology (VCQ) and the Erwin Schrödinger Center for Quantum Science and Technology (ESQ).

## Materials physics

New materials are a central basis of tomorrow's high technology. What materials will work in future sensors or produce high-strength constructions? Carbon-based nanostructures such as carbon nanotubes, fullerenes, graphenes or nanostructured metals and superconductors are investigated by scientists at the University of Vienna. Computer-assisted materials research on all scales is a special focus of the University of Vienna: from atomic quantum simulation and molecular modelling to the description of long-chain polymers and soft matter.

Six research groups are currently active in the materials field. VASP, the Vienna Ab Initio Simulation Package, is one of the world's most successful software packages to simulate material properties. Due to the international market uptake, VASP Software GmbH, in which the University of Vienna holds shares, was founded in 2018.

Together with the Technical University of Vienna, scientists from the University of Vienna are conducting research in the Computational Materials Laboratory, a FWF special research programme. In addition, the universities offer a joint master's programme in Materials Chemistry.

## Vienna Scientific Cluster VSC

The Technical University of Vienna and the University of Vienna are also spearheading the Vienna Scientific Cluster VSC in order to solve highly complex scientific computing tasks in the field of materials and quantum physics. In the autumn of 2019, the participating universities can already use the VSC 4.

## Christian Doppler laboratories

The University of Vienna is also trying to expand high-profile research collaborations between business/industry partners and science. In the field of materials physics, two Christian Doppler laboratories (CD) have been established at the University of Vienna. One CD covers research on magnetic sensors and materials. Another CD laboratory addresses mid-IR spectroscopy and semiconductor optics.

It is planned to establish an additional CD laboratory in the field of quantum physics/photon quantum computers.

**International cutting-edge research**

Research in this field, which is one of the University's strategic priorities, relies on strategic investments from the University of Vienna, the Federal Ministry's structural funds for the higher education area, funds from five ERC Starting Grants, an ERC Consolidator Grant, an ERC Proof of Concept Grant, two ERC Advanced Grants, six FWF START Prizes and an FWF Wittgenstein Prize. Currently, two START Prize projects as well as two ERC Starting Grants and an ERC Consolidator Grant are ongoing. This strategic priority currently comprises 69 third-party funded projects with an average annual total funding volume of 6.9 million euros.

**New professorships**

Newly appointed professors in the last three years
- Low-Dimensional Transport and Nanotechnology
- Quantum Materials Modelling
- Solid-State Physics
- Quantum Information Science and Quantum Computation

Associated professors appointed in the last three years
- Computational Physics
- Condensed Matter Physics
- Computational Physics

Assistant professors appointed in the last three years
- Experimental Condensed Matter Physics
- Theoretical Quantum Physics
- Quantum Optics in Microscopy
- Far-from-Equilibrium Quantum Systems
- Nanomaterials and Nanotechnology

New professors to be appointed
- Quantum Algorithms
- Experimental Quantum Physics
- Experimental Soft Matter Physics
- Computational Material Discovery