

## Quantum sciences

## On the way to practical use

Felix Würsten

**ETH Zurich enjoys a leading position in the quantum sciences. The Executive Board now wants to develop this field to ensure that ETH researchers can be on the front line, not only in basic research, but also in the development of applications.**

Almost all areas of physics would be practically inconceivable without quantum physics. This applies in particular to microscopically small systems like the ones used in information and communication technologies. With quantum physics it is possible to develop completely novel systems, such as storage media that can simultaneously assume status 0 and status 1 instead of just one of these two values. Quantum bits of this kind can be precisely steered today in the laboratory. This is possible thanks to the findings of ETH scientists who have developed the scientific basis for it. This will open the door to developing increasingly high-performance technologies in data processing, sensory technology and image production.

### A huge effort is needed

Despite major progress in basic research, quantum theory has hitherto scarcely been used in a goal-oriented manner in technology. "A huge effort is needed to ensure this potential can be tapped into", explains Andreas Wallraff, Professor for Solid State Physics. A team of professors from the department of Physics as well as the department of Information Technology and Electrical Engineering (ITET) would

now like to further extend research in this area. "ETH Zurich has secured itself a good starting position and now wishes to use this favourable situation in order to be on the front line in the development of viable systems", says Wallraff. And Lukas Novotny, Professor of Photonics at the department ITET adds, "We are entering an age where quantum physics will become the tool of the engineer."

### Fundamental development

Together with the ETH Zurich Foundation, the ETH Executive Board has therefore launched the "Quantum Engineering Initiative." This aims to come up with concrete solutions in the areas of quantum data processing, quantum simulation, quantum sensory technology and image production.

A key element in this initiative is the new "Quantum Engineering" chair, for which recruitment is about to begin. It was intentionally set up within the department ITET, says Wallraff: "Up to now, quantum research was mainly the domain of physics. However, if we want to develop viable systems, engineers' knowledge is essential." The chair comes with a second objective: quantum physics should be included as a subject in the curriculum of electrical engineering and IT to enable specialised experts to be trained in this field in the future.

A second important element in this new initiative is the "Quantum Engineering Centre" (QEC) which is to be developed over the next few years as a research workshop. Compared with ETH centres, for instance the clean room laboratory "First" or the Electron Microscope Centre, which are both

available to researchers in already established technologies, QEC is all about developing new technologies and processes which are needed for the construction of quantum physics elements. Finally, the initiative also envisages a support tool for specific questions. With "Quantum Engineering Grants", individual dissertations and post-doc projects will be funded in order to examine concrete topics in a clearly defined field.

In the initial stage, the researchers involved want to develop basic scalable elements for quantum physics systems. ETH Zurich was able to report a major success in this direction at the end of February. With its promise of a donation to the ETH Zurich Foundation, the Baugarten Foundation has paved the way for the procurement of two high-tech laboratory devices which can be used to manufacture basic elements of this kind. ■

### Your contribution makes a difference

With your financial support you can make a decisive contribution to strengthening the promising field of quantum physics at ETH Zurich. Corinna Adler from the ETH Zurich Foundation will be happy to provide you with more information:

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