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PRESS RELEASE

Race for quantum computers and unbreakable passwords, a new international institute in Trieste

SISSA, ICTP and Trieste University launch the *Trieste Institute for the Theory of Quantum Technologies*

Trieste, 19 March 2019

Supercomputers, cryptography, precision sensors are on the research horizon for a new international centre of excellence that will be inaugurated on Monday 25 March in Trieste. The Institute aims at becoming an international reference point for training and research on quantum technologies, which are now at the centre of a 1 billion euro funding initiative by the European Commission over the next 10 years. The *Trieste Institute for the Theory of Quantum Technologies* (TQT) is a joint venture between the Scuola Internazionale Superiore di Studi Avanzati (SISSA), the Abdus Salam International Centre for Theoretical Physics (ICTP) and the University of Trieste. TQT's inauguration ceremony will be held at ICTP's Budinich Lecture Hall starting at 11:00 am. Quantum computing pioneer Ignacio Cirac from the Max-Planck Institut für Quantenoptik, Germany, will give an inaugural lecture on "Quantum Simulations and the Difficulty of Solving Quantum Many - Body Systems".

The achievements of the first quantum revolution are now part of our daily lives, thanks to smartphones, lasers and imaging technologies such as magnetic resonance. However, the future promises even more powerful, secure and precise technologies, starting from cryptography. Quantum communication will allow the secure transmission of sensitive data such as health or financial records and the use of unbreakable passwords. However, this is just one example. We may have quantum computers, simulators and sensors that will not only allow us to solve problems which are currently unsolvable, but will also be key for medical diagnosis, drug design and much more.

TQT's aims and activities

These topics will be at the core of TQT's research initiatives. The joint institute addresses the need to unite and coordinate activities and skills of the significant and growing number of researchers working in the field of quantum technologies in universities and research institutions in the region. The main aim is to promote collaboration between Italian and foreign scholars, also through the organization of conferences and schools, in order to enhance interdisciplinarity and innovation and maximize international impact.

"The creation of the TQT reflects ICTP's intention to evolve in response to a changing world, initiating efforts where new priorities – and new potential – in science and in the developing world demand ground-breaking research," says ICTP Director Fernando Quevedo. He adds, "Quantum technologies represent some of the most exciting frontiers in science today, and I am confident that our



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joint exploration of their possibilities with our SISSA and University of Trieste colleagues will create important advances in this quickly evolving field."

This is a natural path, given the scientific history and value of Trieste, as SISSA Director, Stefano Ruffo, highlights. "The scientific community working on the theoretical investigation of quantum systems in Trieste is outstanding at both the national and international levels, because of its size and also its research excellence. Moreover, it builds on the work of local scientists, such as Giancarlo Ghirardi, who were pioneers in this field."

Maurizio Fermeglia, Rector of Trieste University, also emphasises the bond between past and future: "Trieste University – always committed to scientific and technological innovation – has been focusing on the evolution of systems for calculation, simulation, transmission and storage of data. This initiative is in line with the past and points clearly to the future, introducing a new paradigm in scientific calculation, that of exploiting the properties of quantum physics to make the computers 'think' in a different, non-linear way."

What are *quantum technologies*?

Quantum technologies are based on the laws of quantum mechanics, which govern physics at the atomic scale. One of their most important applications is quantum computing, which promises a future of unprecedented computing speed. Major computer manufacturers such as IBM, along with search engine giant Google, are already producing quantum computing chips that will someday drive a quantum machine. These new machines will allow us to address problems that even the most powerful classical supercomputers could never solve.

Other applications for quantum technologies include processing big data for artificial intelligence, analysing materials and chemical reactions for the design of new energy technologies or new medications, and strengthening communications security through quantum key distribution.

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