

ICTQT

See Quantum

The centre is implementing a project entitled: "International Centre for Theory of Quantum Technologies." In its operations, ICTQT focuses on research related to cutting-edge quantum technologies, and especially on quantum communications and information, and also quantum theory. In the context of practical solutions, this research concentrates on robust systems for ensuring absolute cybersecurity of data (including quantum, self-testing cryptography), quantum communication protocols, and conceptual work on algorithms for quantum computers.



ICTQT - International Centre for Theory of Quantum Technologies



Prof. Marek Żukowski PhD Hab. and Prof. Paweł Horodecki PhD Hab.



Cybersecurity, quantum optics, quantum information, quantum physics, quantum r&d, quantum thermodynamics, quantum technologies, photonics



In its research, ICTQT explores such fields as quantum communication, quantum algorithms, and quantum networks, and also quantum Internet. These efforts are undertaken in collaboration with some experimental centres



Quotes

*Poland has a great scientific potential in quantum mechanics, but to be able to play an important role in the European Quantum Technologies Flagship initiative, it needs new research facilities, focusing on quantum technologies, with sufficient funds and capable of attracting top international talent. And the International Centre for Theory of Quantum Technologies is exactly such a facility. – **prof. Marek Żukowski.***

*The problems addressed by quantum physics and quantum technologies are among the key challenges of contemporary science. This is a very good time for research initiatives like this, as quantum technologies are now the interest of not only scientists but also governments and large corporations, such as IBM, Google, and Microsoft. In the near future, this research could generate enormous economic benefits. – **prof. Paweł Horodecki.***

$$i\hbar \frac{\partial}{\partial t} \Psi = \hat{H} \Psi$$



Prof. Marek Żukowski PhD Hab. – Director of ICTQT, Full Professor at the University of Gdańsk, Correspondent Member of the Polish Academy of Sciences (PAN), expert in quantum mechanics and quantum interferometry, author of more than 160 research works, published in the world's leading journals. Member of the scientific boards of several institutions, such as the Quantum Information Center in Gdańsk and EU's QUANT-ERA. Winner of the 2013 FNP Award in Mathematical, Physical and Engineering Sciences „for research on multi-photon entangled states, which led to the formulation of information causality as a principle of physics.” Former member of the National Science Centre's board, and former Associate Editor of Physical Review. The results of Professor Żukowski's research on multi-photon entangled states have not only theoretical implications. They have contributed to the development of multi-photon interferometry, which is the basis for experimental implementations of the prototypes of future quantum information technologies, such as quantum teleportation and quantum cryptography.

Prof. Paweł Horodecki PhD Hab. – theoretical physicist, graduate of the University of Gdańsk, he works at the Gdańsk University of Technology and is now in charge of the ICTQT team, member of the Scientific Board at the Quantum Information Center (KCIK). Author and co-author of more than 150 articles in quantum information theory and fundamentals of quantum mechanics. Professor Horodecki is the co-founder of the Quantum Information Center and currently a member of its Scientific Board. He is one of the creators of the Horodecki criterion (1996) for determining if a quantum state is entangled (and the article with this criterion is the most widely cited original scientific paper in the history of the University of Gdańsk). He was also among those who discovered what is known as *bound entanglement* (Physical Review Letters; 1998), and many fundamental laws of quantum information.



Interesting facts

Quantum cryptography offers unconditional security, which means that for the first time in history we can encrypt information and have a mathematical proof that it is only the designated receiver who can decrypt it. ICTQT currently works on it's even stronger variant. In, so-called, self testing protocols the users are protected even from backdoors that could be introduced by a malevolent producer of their devices.

The European Quantum Technologies Flagship initiative is expected to result in „game changing” impacts that benefit economy and society and pave the way to the technological and industrial leadership of the EU. Quantum Technologies Flagship seek to unlock the full potential of quantum technologies and accelerate their development and take-up into commercial products in Europe.



Foreign partner:

Institute for Quantum Optics and Quantum Information (IQOQI) of the Austrian Academy of Sciences in Vienna

Polish partner:

University of Gdańsk



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