

Editorial

Quantum Information Science in Italy (IQIS 2018 Editorial) [†]

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Abstract: The 11th Italian Quantum Information Science conference (IQIS 2018) took place in Catania, Italy, at the Monastero dei Benedettini, from September 17 to 20, 2018. IQIS 2018 was organized by the Department of Physics and Astronomy “E. Majorana” of the University of Catania, and by IMM-CNR, Catania. The conference also hosted an event dedicated to the FET-Flagship 2018/28 on *Quantum Technologies*. These proceedings collect papers contributed by the participants, which extend presentations delivered at the conference, and were subjected to peer-reviewing. They provide a snapshot of the contributions (mainly, but only) by the Italian scientific community to the developing field of quantum information and related subjects.

Keywords: quantum science; quantum technologies; information theory

Quantum science and technology are gradually pervading research laboratories, scholarly blackboards, as well as everyday life. As we increase and refine our ability to detect and manipulate single quantum objects, such as atoms, photons or electrons, quantum technologies start creeping into objects of common use, as smartphones and their embedded GPS positioning system, which in turn relies on remote atomic clocks, or secure Internet connection, exploiting quantum communication to prevent eavesdropping, or quantum sensors, as those employed in medical imaging e.g., of the brain activity, or quantum computers [1,2], which Google is planning to use to boost applications in artificial intelligence (a very recent paper claims that more than 1200 mathematical theorems have been algorithmically proved with such techniques [3,4]). This has been hailed as the *second quantum revolution*, after, of course, the first quantum revolution set forth by the forefathers of quantum theory at the beginning of the 20th century. In particular, the subject of quantum information and computation is sufficiently mature for whole textbooks to be available [5], and to even suggest developments in the design of novel condensed matter systems [6].

In this respect, the European Commission allocated an investment of a billion euro to start a Quantum Technologies Flagship in 2018 [7]. The Italian scientific community responded quite immediately, by including the Quantum Technologies Flagship in the Future and Emerging

Technologies (FETs), to be coordinated by the National Research Council (CNR) for a period of ten years, to the aim of translating results from fundamental research, also including quantum optics and coherent matter technology, into actual technology hopefully to be adopted by the industry. Educational programmes at the PhD level entirely dedicated to quantum science and technology are being born e.g., at the universities of Trento and Naples, national or partly national research bodies such as the the Italian Institute of Technology (IIT) in Genova, the International Centre of Theoretical Physics (ICTP) in Trieste, the University of Rome ‘La Sapienza’ through the Quantum Lab, the National Institute of Optics (CNR-INO) and the European Laboratory for Non-Linear Spectroscopy (CNR-LENS), both in Firenze, are initiating and strengthening a nation-wide research network, which obviously possesses roots and branches both in Europe and overseas.

Since 2008, IQIS conferences aim to bring together researchers in quantum information and related technologies, active in Italy and abroad. Professors, young researchers, postdocs and students have the opportunity to meet active research groups and establish collaborations. These proceedings collect peer-reviewed extended papers, contributed by the participants to the 11th Italian Quantum Information Science conference (IQIS 2018, Figure 1), which took place in Catania, Italy, at the Monastero dei Benedettini, from September 17 to 20, 2018. The Conference pushes forward the work and aims of the Italian Quantum community and agenda, first set in Camerino in 2008 and then continued in Pisa (2009), Torino (2010), Vietri (2011), Padova (2012), Como (2013), Salerno (2014), Monopoli (2015), Rome (2016), and Florence (2017). IQIS 2018 was organized by the Department of Physics and Astronomy “E. Majorana” of the University of Catania, and by IMM-CNR, Catania. The conference also hosted an event dedicated to the FET-Flagship 2018/28 on *Quantum Technologies*.

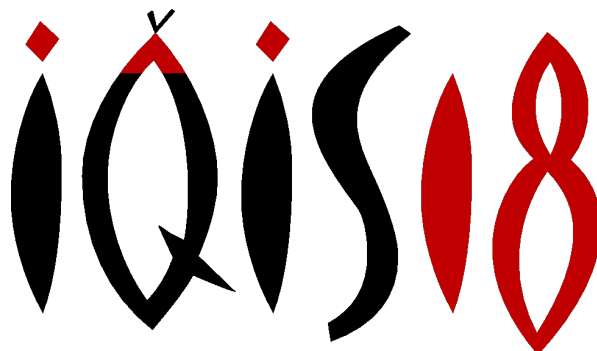


Figure 1. IQIS 2018: the conference logo.

The main topics of the conference included quantum technologies (computation, simulation, communication, sensing and metrology), fundamental quantum science (entanglement, open quantum systems, decoherence and non-Markovianity, quantum measurement), quantum hardware (atoms and molecules, solid-state devices, quantum photonics), special selected topics (quantum control, speed limits and geometric aspects, quantum networking, quantum many-body systems, quantum thermodynamics, quantum gravity), as well as related subjects (information theory, foundations of computer science, condensed matter physics and materials). Over 80 people were in the attendance (Figure 2), from all over Europe, as well as beyond.

During the conference, the 2017 G. Davide Paparo Prize was awarded by the G. D. Paparo Foundation to A. Mari, ‘for his contributions on the control of quantum thermodynamic cycles and quantum optoelectronic devices’ (see Ref. [8] in this issue, and references therein). The prizes for the Young IQIS best oral presentation and for the Young IQIS best poster presentations were also awarded to M. Avesani [9] and S. Di Giorgio [10], respectively. Both awards were supported by the Julian Schwinger Foundation (JSF), which we gratefully acknowledge, also for general support to the participants to the Young IQIS session.

By collecting together the present proceedings, the organizers of IQIS 2018 and the editors hope that they can provide a useful and comprehensive snapshot of the contributions (mainly, but only) by the Italian scientific community to the developing field of quantum information and related subjects.



Figure 2. IQIS 2018: group photograph (by A. La Rocca).

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