12th Winter School on Quantum Cybersecurity

PROGRAM

“Quantum Communications Horizon 2030”

WINTER SCHOOL

25-31 January 2020

Les Diablerets - Switzerland

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The theme for this year 12th Winter School is: “Quantum Communications Horizon 2030”.
The thread of the program is to review the situation of quantum communications in 2020 and to attempt to forecast its status in 2030, when the quantum computer should be close to completion.

Following our tradition, the 2020 event will again feature a two-track program. The two-day Industry Track will provide a high level overview of quantum threats and cyber security. The in-depth Technology Track, which will last 6 days, will go into technical details. Now is the time to learn about both in the relaxed, healthy and stimulating environment of the Les Diablerets winter resort in the Swiss Alps.

- **The Industry Track**, given over the first two days, is aimed at our colleagues in cyber security; for example CISOs, security experts, or engineers, who wish to gain a high level of proficiency in emerging quantum technologies. It will introduce quantum cryptography, quantum-safe security, and quantum computers in a way accessible to all. The goal is to provide tools for a better assessment of the risks and opportunities brought about by these new quantum technologies.
- **The Technology Track**, includes the previous Industry Track, and extends it by four more days. The Technology Track is aimed at a general audience of physicists, engineers and computer scientists with little or no background in quantum communications. They will start with the Industry Track, to give a high level picture, and then go into technical details. In this track, special emphasis will be placed on practical aspects, such as the implementation of quantum key distribution systems and quantum repeaters, as well as concrete steps towards a quantum computer. The emerging applications of these promising technologies will also be discussed.

The goal of this event is to introduce this exciting topic in a relaxed and stimulating atmosphere. It will allow extensive interactions between instructors and participants from a variety of backgrounds. In addition, by including hands-on sessions, the Winter School will offer to the participants the unique opportunity to learn, to see and even operate a real quantum cryptography system and single-photon detectors.

In order to maximise interaction with instructors and to allow intensive hands-on sessions, the number of participants is limited. Applications will be accepted on a first-come first-served basis.

Dates:	Industry Track: Saturday January 25th to Monday January 27th, 2020 (Arrival on Saturday afternoon and departure on Monday after the courses) Technology Track: Saturday January 25th to Friday January 31st, 2020 (Arrival on Saturday afternoon and departure on Friday noon) It is possible to extend your stay in Les Diablerets ski resort before or after the Winter School (contact us).
Location:	Les Diablerets ski resort in the Swiss Alps (More information available here)
Accomodation:	Hotel Les Sources: www.hotel-les-sources.ch
Instructors:	Members of the ID Quantique team
Speakers:	See pages 6 to 8 of this announcement

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Price: Industry track (2 days): € 2'000 per participant
Technology track (6 days): € 4'000 per participant

The price includes:
- Board and accommodation (2/6 nights, single room in a *** hotel)
- Course participation
- Teaching materials
- Recreational activities (as described in the program)

Note: Travel to and from Les Diablerets not included.

Certificate: Granted upon completion of the Winter School

Insurance: Health and accident insurance is the responsibility of the participant.

Accompanying person: Possibility to come with an accompanying person.
Price: € 1'500 per additional person, which includes:
Accommodation in a double room, breakfast, lunch and dinner, and recreational activities.
Note: Travel to and from Les Diablerets not included.

Important note: The number of participants is limited. Applications will be accepted on a first come first served basis. Due to the high number of demands, we also limit to 3 the number of participants from the same company.

Come and join us in Les Diablerets next winter! This Winter School is a unique opportunity to learn about state-of-the-art practical quantum communications and to gain experience. The program will also allow participants to network and socialise, while discovering winter sports such as snowshoeing, sledging and curling in a beautiful Swiss Alps winter landscape.

For more information, write us at winterschool@idquantique.com

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PRELIMINARY PROGRAM

DAY	SATURDAY 25th JANUARY
From 15:00	Arrival of the participants
16:00 - 17:00	**Welcome drinks** Registration and Presentation of the program
17:00 - 18:30	**Introduction** **The context of quantum security** M. Mosca **IQC**
18:30 - 20:00	Dinner
20:30 - 22:00	**Recreational Activity** Curling

LEGEND
Lectures
Hands-on Sessions
Recreational Activities
Meals
Various

INDUSTRY TRACK

DAY	SUNDAY 26th JANUARY	MONDAY 27th JANUARY	
TIME	Industry/ Technology Tracks	Industry Track / Technology Track	
07:15 - 08:00	Breakfast	Breakfast	
08:30 - 10:00	**The new age of computation** A. Ekert **Uni Oxford**	**Cybersecurity Today** J. Baloo **KPN/Avast**	
10:30 - 12:00	**Quantum Computer - Status and progress** H. Riel **IBM**	**Post-quantum cybersecurity** L. Perret **CryptoNext Security**	
12:00 - 13:30	Lunch	Lunch / **End of Industry track**	
13:30 - 15:00	**Quantum Communications** G. Ribordy **IDQ**	**Recreational Activity** Snow activity	
15:20 - 16:50	**Quantum Random Number Generation** F. Bussières **IDQ**		
17:10 - 18:40	**QKD in Space** H. Hauschildt **ESA**	**Cryptography in a quantum world** G. Brassard **Uni Montréal**	
18:40 - 20:00	Dinner	Dinner	
20:00 - 21:30	After dinner talk **History of BB84** G. Brassard	**Quantum Networks** R. Pravahan **AT&T**	

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TECHNOLOGY TRACK

TIME	TUESDAY 28th JANUARY	TIME	WEDNESDAY 29th JANUARY	THURSDAY 30th JANUARY	FRIDAY 31st JANUARY
07:15 - 08:00	Breakfast	07:15 - 08:00	Breakfast	Breakfast	Breakfast
08:00 - 09:30	**QKD: Session 1** IDQ R&D Team	08:00 - 09:30	**Quantum Hacking** V. Makarov	**What is quantum computation** S. Popescu **Uni Bristol**	**Wrap up session and discussions (optional)** IDQ Team
10:00 - 12:00	**QKD: Session 2** IDQ R&D Team	10:00 - 12:30	**Hands-on Sessions**	**Hands-on Sessions**	
12:00 - 16:30	**Recreational Activity** Glacier 3000 (with lunch)	12:30 - 14:00	Lunch	Lunch	Lunch (optional)
		14:00 - 16:30	**Hands-on Sessions**	**Hands-on Sessions**	
17:00 - 18:30	**CV-QKD** R Alléaume **Paris Tech**	17:00 - 18:30	**Security Proofs of QKD** R. Renner **ETHZ**	**Latest developments in Quantum Cryptography** N. Gisin **Unige**	**End of program**
18:30 - 20:00	Dinner	18:30 - 22:00	**Dinner & Recreational Activity** Evening Sledge	Final Dinner	
20:00 - 22:00	Free time				

End of the school: Friday 31st January 2020 around 11 AM

Notes:

- For hands-on sessions, participants will work in groups. Each group will take part in the following tutorials:
  - Quantum Key Distribution
  - Single photon technologies
  - Quantum hacking
  - Quantum Random Number Gernerator
- The courses will not focus solely on ID Quantique's products, but will use them for illustrative purposes.
- All presentations are in English.

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CONFIRMED SPEAKERS

Prof. Romain Alléaume
Telecom ParisTech (France)

Romain is a leading expert in coherent quantum communications. He has a dual experience in academia and industry as a co-founder of the startup company SeQureNet, which has developped the first continuous-variable QKD product. At the winter school, he will introduce us to continuous-variable QKD.

Prof. Gilles Brassard FRS, O.C., O.Q.
Canada Research Chair in Quantum Information Science, Université de Montréal, (Canada)

Gilles is one of the two B's in the celebrated BB84 protocol. Together with Charles Bennett, he is rightly considered as one of the inventors of Quantum Cryptography. Gilles and Charles are also among the inventors of quantum teleportation. Gilles is a regular guest at the Winter school, where he shares both his views as one of the founding fathers, and his understanding of future directions.
Meet Gilles on his webpage: www-labs.iro.umontreal.ca/~brassard/web/en/

Prof. Artur Ekert, FRS
University of Oxford (UK) and Center for Quantum Technologies (Singapore)

Artur is one of the pioneers of QKD, inventor of the famous E91 protocol, which suggested the use of entangled states for QKD. The exchange of entangled states is the concept at the origin of the future quantum internet.
He is also the Director of the CQT in Singapore, leading the research on information processing in quantum mechanical systems.

Prof. Nicolas Gisin
University of Geneva (Switzerland)

Nicolas is one of the pioneers of QKD in telecom fibers. He combined his expertise in optical fibers and in quantum effects in optical fibers to propose and realize key experiments and practical implementations. He is also one of the founders of ID Quantique.

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Dr. Harald Hauschildt
ESA (Germany)

Harald is the ESA Program Manager for the ScyLight Program, dedicated to Optical Communication and Space Based Quantum Cryptography.
He is also preparing the "Secure and Cryptographic Mission addressing Quantum Key Distribution from Space as well as the extension of the European Data Relay System (EDRS) to provide global coverage.

Prof. Vadim Makarov
Russian Quantum Center (Moscow, Russia)

Vadim is the best-known quantum hacker. He has been trying (with sometimes too much success for our taste!) to find side-channel attacks on QKD protocols, and has been collaborating with IDQ to improve the QKD systems as a result.

Prof. Michele Mosca
Institute of Quantum Computing (Waterloo, Canada)

Michele is co-founder of the IQC. He is a very vocal proponent of Quantum-Safe Security. Michele is also famous, inter alia, for the Mosca equation: "If X+Y>Z then Worry!" (which will be explained during the school)

Dr. Ludovic Perret
CryptoNext

Ludovic is the co-founder & CEO of CryptoNext. He works since more than 10 years in post-quantum Cryptography. Ludovic is the co-author of several submission to the on-going NIST post-quantum standardization process. He is also co-chair of the Quantum-Safe Security working group of the CSA and invited expert at the ITU-T-SG-17.

Prof. Sandu Popescu, FRS
University of Bristol (UK)

Sandu is one of the founders of quantum information theory, which is at the heart of the whole field of quantum communication. Sandu is a regular guest at the WS, and a much appreciated one.
Meet Sandu on his webpage: www.sandupopescu.com

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Prof. Renato Renner
Swiss Federal Institute of Technology (Switzerland)

Renato is Head of Quantum Information Group at the ETHZ. He is working on security proofs of QKD, amongst other topics. At the Winter School, Renato is famous for being the only person using a blackboard for his lectures. And he does succeed in explaining very clearly how quantum hacking and security proofs are compatible.

Dr. Grégoire Ribordy
ID Quantique (Switzerland)

Grégoire is the CEO of ID Quantique, and your host for the Winter School. Grégoire is a scientist as well as an entrepreneur. He is a world expert in quantum communications and the recipient of several awards for technology entrepreneurship.

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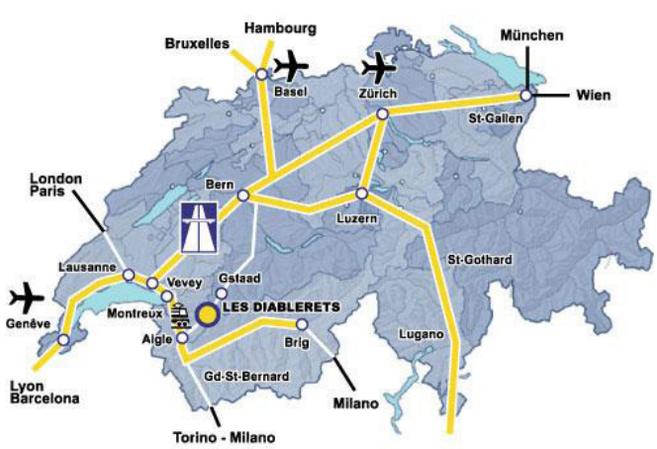
Join us at Les Diablerets!

(www.villars-diablerets.ch)

Enjoy the pure mountain air in a charming family resort at the foot of a magnificent glacier.
Les Diablerets is an unspoiled country village set amid spectacular Alpine scenery. Majestic summits, pristine forests...
Les Diablerets has done such a good job of meeting the needs of tourism that visitors feel right at home!

In winter, the mountain offers you all the pleasures of skiing, snow and meeting family or friends: Alpine skiing and snowboarding, but also cross-country skiing, snowshoes or hikes, day or night sledge runs, ice-skating or curling, swimming-pool and other sports or fun activities. In summer, the numerous beautiful landscapes of our valley guarantee you will enjoy sun and pure air. Hikes, mountain biking, Via Ferrata, husky rides and snow bus on the glacier as well as fun sports guarantee you well-being, fun and a unique experience. The Alpine Coaster, on the glacier, with its ten curves, six waves, three jumps, two bridges and a 520-degree loop await those who dare.



More instruction on how to come will be given closer to the arrival date

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