

Quantum physics in advanced technology

Nom	Company	Date	Title	Resume
Zaki Leghtas	Alice & Bob	19-janv	Quantum information with superconducting circuits	In this presentation I will introduce superconducting circuits and explain how they are being widely used to encode, protect and manipulate quantum information. The remarkable progress achieved over the last 20 years in this field has triggered a recent interest of the industrial sector, which I will briefly review.
Dimitri Labat	Chipiron	26-janv	Portable MRI for medical imaging based on superconducting detectors	MRI is the most powerful and versatile medical imaging technique to date, yet it remains very inaccessible due to its cost and the technical constraints related to the use of high magnetic fields (of the order of Tesla) produced by a superconducting magnet. Chipiron is building an MRI system based on low-Tc SQUID, high sensitivity magnetometers with flat frequency response. These features allow the working field to be lowered to milliTesla while maintaining images of sufficient high quality for diagnosis.
Mathias VAN DEN BOSSCHE	THALES-Alenia Space	02-févr	Satellite Quantum Information Networks - status and research need	Quantum communication networks will require satellites to allow efficient long distance links. This presentation introduces key concepts in quantum communications, and then draws the focus on quantum information networks (QIN) that will allow generic quantum state transfers between processors or sensors, or both. The overall architecture principles of QIN systems are detailed, critical enabler and key performance drivers are identified. The state of the art for the various elements is presented, and the progress needs in specific domains to go beyond proof of principle are identified.

Pierre Jouy	IrSweep	09-févr	Micro-second reaction monitoring with broadband quantum cascade lasers	High time resolution broadband spectroscopy is the key to monitor many fast chemical or biological reactions. A plethora of application can benefit from such information, ranging from biology research laboratories to industrial producers of combustibles and passing by pharmaceutical manufacturers. At IRsweep, we use dual frequency comb systems based on quantum cascade lasers to reach state of the art performances for our mid-infrared spectrometer. I will present the physics behind this technique, the challenges and future required developments as well as some applications while sharing my personal experience in the world of a high tech start-up.
Pascale Senellart & Pierre-Emmanuel Emeriau	QUANDELA	16-févr	Quantum optics with solid-state emitters: toward a quantum computing platform	In this presentation, we will discuss how conducting fundamental studies of light-matter interaction with semiconductor quantum dots, our team progressively developed useful devices for optical quantum technologies. These devices, namely efficient sources of single photons, are now commercialised by Quandela, a spin-off company created in 2017. With continuing progresses on the technological side, Quandela is now working on the development of an intermediate-scale quantum computing platform based on photons. We will discuss the assets and challenges of such a platform.
Christophe Jurczak & Pauline Boucher	Quantonation	01-mars	Investing in the quantum future: how venture capital and startups are driving quantum innovation	Quantonation is a very special fund, investing exclusively in startups leveraging quantum technologies and what we call "deep physics". We back startups - in their vast majority founded by quantum physicists - from day one, towards growth and ultimately putting products on markets for applications that have a deep impact on society. We have invested in Pasqal (neutral atoms quantum computing), Quandela (photonics), Nord Quantique (superconducting qubits), Cryptonext (post-quantum cryptography), Qnami (quantum sensing) and many more, all around the world. We have been both trained as quantum scientists and will discuss exciting opportunities, but also challenges and pitfalls for the emerging quantum industry.
Vincent Ménoret	Exail Quantum Sensors	08-mars	Industrial quantum gravity sensors: from research labs to volcanoes	Transforming a high-precision laboratory experiment into a commercial instrument is a long process. I will describe the challenges faced by Exail Quantum Sensors (formerly Muquans) during the development of a cold atom absolute gravimeter, and show some examples of applications.

Eleni Diamanti	WeLinQ	15-mars	Secure communication in quantum networks	In this presentation, we will discuss the basic concepts and current landscape in the field of quantum communication and cryptography. We will focus in particular on photonic implementations demonstrating flagship protocols such as quantum key distribution, and describe the present challenges in the field, including miniaturization and telecom infrastructure integration. Among those challenges, the ability to efficiently store and retrieve quantum information is crucial for establishing long-distance quantum communication links and for interconnecting quantum devices. This challenge is addressed by the spin-off company Weling created in the beginning of 2022.
Sylvain Gigan	LightOn	22-mars	Computing with white paint? yes, we can.	I will describe our path, from fundamentals of light in complex media and biological imaging in our team at the physics department of ENS, to the founding of LightOn, a young startup that proposes to address modern machine learning challenges, leveraging on the same concepts, i.e. what I would call « optical computing with white paint.