

meeting SQMS italia

14-15 october 2021

QIS ecosystem

a report

Paola Derrucchi

Stefania De Cufis (GGI)

firenze

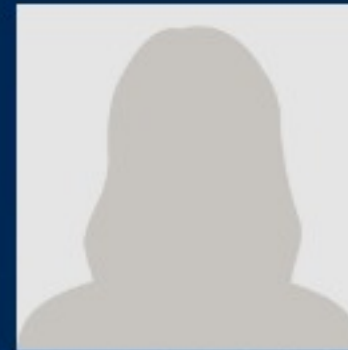
QIS Ecosystem



Leaders



Ecosystem taskforce



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firenze

- internship
- conference/workshop/program
- school



internship



INFN & DOE



INFN & SQMS



U.S. DEPARTMENT OF
ENERGY



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Welcome to the DOE - INFN Summer Students Exchange Program

2020 Edition

The **US Department of Energy (DoE)**
and the **National Institute for Nuclear Physics - Italy (INFN)**
announce the 2020 edition of the Summer Exchange Program,
dedicated to the exchange of US and Italian students
in science and engineering.

Deadline 27/03/2020

DOE-INFN Summer Students Exchange Program 2019 Edition

The US Department of Energy (DOE) and the Istituto Nazionale di Fisica Nucleare of Italy (INFN) announce the 2019 edition of the Summer Exchange Program dedicated to promote the exchange of students in science between the two countries.

INFN (<http://www.infn.it>) is one of the leading organization worldwide promoting basic scientific research and has tight connections with DOE activities in many areas of interest: Particle Physics, Astroparticle Physics, Nuclear Physics, Theoretical Physics and Detector Physics.

We call for applications of US students willing to join a INFN research team in Italy for a two-month period between **June 1st and October 31st, 2019**.

There are **11 positions** available in 15 different INFN sites with a 60 research projects. Grants amount to **Euro 5000** for covering travel and living expenses. They are subjected to a **30%** reduction due to Italian income taxes.

Eligible candidates must be enrolled as students at a US university and they must have begun, at the time of application, at least the third year of a US University curriculum in physics, engineering or computing science, **or planning to start the third year in 2019**.

Applications, in electronic form, must be sent to INFN not later than **April 7th, 2019** (11.59 a.m CET) through the website: <https://reclutamento.infn.it/ReclutamentoOnline/>

The application should include:

- a short CV following the template provided in the recruitment site, describing their academic and research experience and indicating the University courses and scores. Only PDF files will be accepted.
- the three preferred INFN sites and the research topics of interest chosen among those listed in the Annex I.
- the motivation for applying to this program and a statement of research interests for the work of the candidate at the selected INFN sites.
- the name and e-mail address of at least one of their professors or tutors who might be contacted by us to provide a reference letter

Selection of participants will be carried out by the Selection Committee and participants will be informed of the outcome of their applications by April 30th.

Selected students will be contacted by the Directors of the relevant INFN sites who will send out the official invitation letter. Selected students are also requested to send their official University transcript by e-mail (digital scanned copy).

Since September 2010, citizens of countries like US may enter Italy for a period of up to 90 days without a visa, to take part in the exchange program (please check here <http://vistoperitalia.esteri.it/home/en>).

Sandra Leone (sandra.leone@pi.infn.it)

INFN National Scientific Coordinator DOE-INFN Summer Students Exchange Program

Giacomo Betti (giacomo.betti@pi.infn.it)

INFN National Secretariat DOE-INFN Summer Students Exchange Program

FIRENZE

SQMS / SFT (Superconducting Quantum Materials and Systems / Statistical Field Theory)

Title: Quantum algorithms and simulation methods for noisy intermediate-scale quantum processors

Description: This activity sets in the framework of the DOE project “Superconducting Quantum Materials and Systems”, to which INFN takes part as the only European partner. SQMS has two main goals: develop quantum devices based on a combination of superconducting RF cavities and trasmons, and develop detection technologies for quantum states of very-low energy for applications in experimental fundamental physics. The INFN – Sezione di Firenze takes part to the project contributing to the theoretical work of the “Algorithms and Simulation” thrust. In particular, the research group involved will study new quantum algorithms and quantum simulation methods, specifically designed for current noisy intermediate scale quantum processors. Researchers of the group have theoretical expertise on benchmarking and programming such processors, possibly with hybrid quantum-classical procedures. They have studied how to map relevant problems of practical interest, such as combinatorial optimization problems or problems arising in material science or chemistry, into operations that can be performed in superconducting gate-based quantum computers or (Gaussian) boson sampling devices. The student who will possibly join the group will study how to tackle the unavoidable noise of these devices and help improving the available algorithms using feedback from probabilistic quantum-measurement outcomes. She/He might also take part to the design of new simulation methods to study non-equilibrium quantum effects with transmon devices, directly using the hardware to estimate low-energy excited states of quantum many-body systems. Finally, the student is welcome to participate in activities related to the SQMS project, or anyway of interest, that will possibly take place at the INFN Galileo Galilei Institute for Theoretical Physics during her/his time in Firenze.

Further references:

<https://sqms.fnal.gov/>

https://home.infn.it/newsletter-eu/pdf/NEWSL_INF_N_75_ing_2.pdf

<https://www.ggi.infn.it>

Tutors:

Leonardo Banchi leonardo.banchi@unifi.it

Alessandro Cuccoli cuccoli@fi.infn.it

Laura Gentini laura.gentini@unifi.it

Paola Verrucchi verrucchi@fi.infn.it

Recommended period: June-July or September-October (one of the Tutors will always be available).

Other information: INFN Sezione di Firenze and GGI will be mainly closed during the first three weeks of August. Budget accommodations might be made available via our organization.

Local Secretariat:



internship



INFN & DOE



INFN & SQMS



● internship → INFN & DOE
→ INFN & SQMS

● conference / workshop / school ?

● internship → INFN & DOE
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● conference / workshop / school

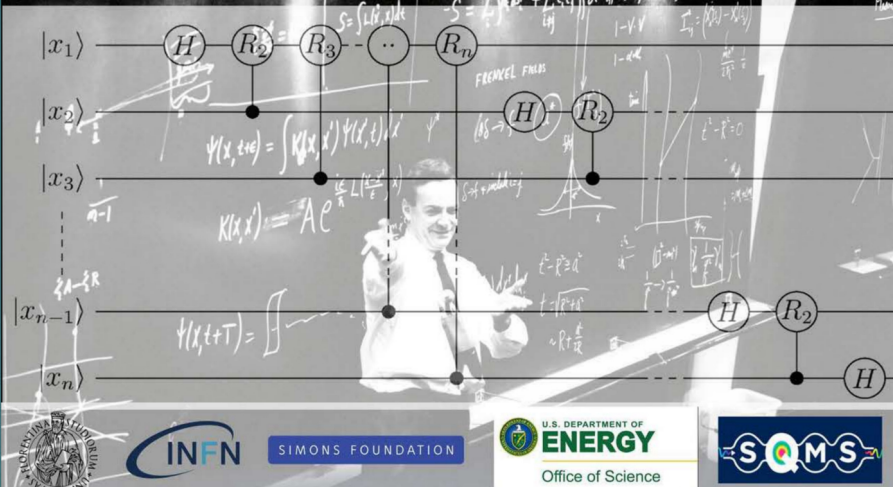
● school → 2021
→ 2022

QUANTUM COMPUTATION AND SENSING

Deadline: April 30, 2021

ONLINE EVENT
Jun 21 - Jul 02, 2021

In collaboration with the U.S. Department of Energy, Office of Science,
National Quantum Information Science Research Centers,
Superconducting Quantum Materials and Systems Center (SQMS)



Topics

- Light-matter interaction in circuit QED
- Quantum controls and algorithms
- Superconducting circuits
- Metrology in circuit QED
- Quantum sensing

Lecturers

- Alexandre Blais, Université de Sherbrooke (CA-QC)
- Caterina Braggio, Univ. and INFN Padova (IT)
- Elisa Ercolessi, Univ. and INFN Bologna (IT)
- Peter Graham, Stanford University (US-CA)
- Jens Koch, Northwestern University (US-IL)
- Hanhee Paik, IBM Watson Research Center (US-NY)

Organizers:

Caterina Braggio, Univ and INFN Padova
Laura Cardani, INFN Roma
Roni Harnik, Fermilab Chicago Illinois
Yonatan Kahn, University of Illinois at Urbana-Champaign
Raffaele Tripiccione, Univ. and INFN Ferrara
Paola Verrucchi, CNR Institute for Complex Systems and INFN Firenze

APPLY NOW

www.ggi.infn.it/quantum

PROGRAM

- Light-matter interaction in circuit QED
 - Jaynes Cummings Hamiltonian
 - Dispersive regime
 - Rabi oscillation and decoherence
- Quantum controls and algorithms
 - Single qubit gates
 - Two qubit gates
 - Optimal quantum controls
 - Channels and noise
- Superconducting circuits
 - LC, 2D, 3D resonators
 - Superconducting qubits (transmon, flux tunable, others)
- Metrology in circuit QED
 - Phase space representation
 - Time vs Frequency regimes
 - Dispersive qubit readout
 - Qubit calibration
- Quantum sensing
 - Dark matters and coupling
 - Experiment design
 - Dark matter and axion searches and experiments
 - Quantum-limited amplification with JPAs
 - Squeezing and single photon detection



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The Galileo Galilei Institute For Theoretical Physics

Centro Nazionale di Studi Avanzati dell'Istituto Nazionale di Fisica Nucleare

Arcetri, Firenze



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Event at Galileo Galilei Institute

School

Quantum Computation and Sensing

Online Event

Jun 21, 2021 - Jul 02, 2021

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Quantum Computation and Sensing

Online Event

Jun 21, 2021 - Jul 02, 2021

Abstract

The school is addressed to PhD students in quantum information science, particle physics and condensed matter. The students will be introduced to basic concepts in circuit quantum electrodynamics, quantum controls and metrology. The school will also cover main topics in quantum sensing at the precision frontier, quantum-limited amplification and microwave photon counting to significantly improve the sensitivity in axions detection and other dark matter candidates interactions. Participation of experimentalists and post-docs is also encouraged. In 2021 the school will be virtual, from June 21 to July 2. The schedule will be arranged to accommodate students from the US and European time zones.

The school is organized in collaboration with the U.S. Department of Energy, Office of Science, National Quantum Information Science Research Centers, Superconducting Quantum Materials and Systems Center (SQMS).

There is no fee for participation.

Topics

Light-matter interaction in circuit QED

Quantum controls and algorithms

Superconducting circuits

Metrology in circuit QED

Quantum sensing



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Lecturers

Alexandre Blais, Département de Physique, Université de Sherbrooke (CA-QC)

Caterina Braggio, Dipartimento di Fisica ed Astronomia UNIPD and INFN Padova (IT)

Elisa Ercolessi, Dipartimento di Fisica ed Astronomia UNIBO and INFN Bologna (IT)

Peter Graham, Stanford Institute for Theoretical Physics, Department of Physics, Stanford University, Stanford (US-CA)

Jens Koch, Northwestern–Fermilab Center for Applied Physics and Superconducting Technologies, Northwestern University, Evanston (US-IL)

Hanhee Paik, IBM T. J. Watson Research Center, Yorktown Heights (US-NY)

and

Speakers

Nathan Shammah, Unitary Fund

Matteo Rini, American Physical Society

Daniil Frolov, Fermi National Accelerator Lab., Batavia (US-IL)

Angelo Cruciani, INFN Roma1 (IT)

Organizers

Caterina Braggio, Dipartimento di Fisica ed Astronomia UNIPD and INFN Padova

Laura Cardani, INFN Roma

Roni Harnik, Theoretical Physics Department, Fermilab Chicago Illinois USA

Yonatan Kahn, Department of Physics, University of Illinois at Urbana-Champaign, USA

Raffaele Tripiccione, Dipartimento di Fisica e Scienze della Terra UNIFE and INFN Ferrara

Paola Verrucchi, CNR Institute for Complex Systems and INFN Firenze

Silvia Zorzetti, NQI National Quantum Center - SQMS division, Fermilab Chicago Illinois USA



Verena Feulner

Kevin Joven

Laura Cardani

Paola Verrucchi

Salvatore Montella

Matteo Lugli

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Paolo Braccia

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Renata Wong

Tao Xu

Ziwen Huang

Federico Chiossi

Benjamin Groleau-Paré

Federico Dell'Anna

Elham Faraji

Stefan Knirck

michelevischi

Selomit Ramírez

Andres R Olivo

Mario Chizzini

Daniel Bafia

Jens Koch

Leonardo Badurina

Stefania De Curtis

Luca Crippa

Nick

Ignazio Vacante

Ghofrane Bel Hadj Aissa

Arpita Mitra

Muhammad Hani Zaheer

Jason Saroni

Yulia Krasnikova

Changqing Wang

Cristóbal Lledó

Stefano Mangini

GGI 1

“Quantum computation and sensing” June 21st- July 2nd 2021

Please notice that 9am CDT(Fermilab-Batavia IL) = 16:00 CEST(GGI-Firenze)

INTRO&COMMUNICATIONS (15min) → 9:00am to 9:15am CDT = 16:00 to 16:15 CEST

SLOT A (90 min)→ 9:15am to 10:45am CDT = 16:15 to 17:45 CEST

SLOT B (90 min)→ 11:00am to 12:30pm CDT = 18:00 to 19:30 CEST

EXTRA (45 min) → 12:45pm to 1:30pm CDT = 19:45 to 20:30 CEST

Week 1 : 06/21 to 06/25					
	Monday 06/21	Tuesday 06/22	Wednesday 06/23	Thursday 06/24	Friday 06/25
Intro&Comm.	opening @8:45	Q&A recap	Q&A recap	Q&A recap	Q&A recap
SLOT A	Graham	Ercolessi	Ercolessi	Ercolessi	Koch
15min break					
SLOT B	Graham	Graham	Paik Koch	Koch	discussion
EXTRA	discussion	Shammah (a)	discussion	discussion	

Week 2 : 06/28 to 07/02					
	Monday 06/28	Tuesday 06/29	Wednesday 06/30	Thursday 07/01	Friday 07/02
Intro&Comm.	Q&A recap	Q&A recap	Q&A recap	Q&A recap	Q&A recap
SLOT A	Koch Blais	Blais	Braggio	Braggio	Paik
15min break					
SLOT B	Blais	Blais Paik	Blais	Paik	discussion closing
EXTRA	Frolov	Shammah (b)	Cruciani	Rini	

Quantum Sensing for Particle Physics and Cosmology → Peter Graham
Quantum algorithms and protocols → Elisa Ercolessi
Introduction to superconducting circuits and circuit-QED → Jens Koch with Hanhee Paik
Qbit measurements and signatures of light-matter coupling → Alexandre Blais
Quantum information processing with circuit-QED → Hanhee Paik
Quantum sensing: searches with 3D cavities → Caterina Braggio

Nathan Shammah, Chief Tech. Officer of Unitary Fund:

”Open-source software tools in quantum science”:

- ”Make your code count: Leveraging open-source tools in quantum technology”
- ”Open-source quantum circuit simulation and quantum error mitigation with QuTiP and Mitiq”

Matteo Rini, Deputy Editor for American Physical Society :

“Communication in Science”

Daniil Frolov, Fermilab:

“Superconducting qubits characterization. Live tour of testing facilities at Fermilab.”

Angelo Cruciani, INFN sezione di Roma1:

“Cryogenic facilities for superconducting qubits”



- conference / workshop / school ?

