Secondo Congresso Nazionale NQSTI

Report of Contributions

https://nqsti-indico.fisica.unimib.it/e/secondo-congresso-nqsti

Contribution ID: **1** Type: **not specified**

Ferromagnetism in an atomic quantum spin mixture

Thursday, 6 February 2025 09:00 (15 minutes)

At CNR-INO lab in Trento we realize highly tunable quantum spin mixtures of sodim atoms, exhibiting magnetic properties. Such an experimental platform is extremely versatile and can be exploited as quantum simulator of different phenomena.

Presenter: LAMPORESI, Giacomo (CNR INO Trento)

Session Classification: Sessioni parallele

Track Classification: A6.1 Atoms

Contribution ID: **2** Type: **not specified**

Atomtronics circuits with ultracold matter

Thursday, 6 February 2025 09:15 (15 minutes)

I present our results on quantum transport with ultracold atoms in engineered optical circuits. I will describe our works on ultracold atoms in ring potentials, mimicking the behaviour of electrons in solid state devices.

Presenter: ROATI, Giacomo (CNR INO Firenze)

Session Classification: Sessioni parallele

Track Classification: A6.1 Atoms

Contribution ID: **3** Type: **not specified**

Silicon On Insulator CNOT gate

Thursday, 6 February 2025 09:30 (15 minutes)

The research in linear optics quantum computing aims to optimize a Silicon Photonic Integrated Circuit, focusing on the universal two-qubit Controlled-NOT gate prototype, which operates on a linear, coincidence basis with single-photon inputs.

Presenter: DAO, Thu Ha (INFN Roma 2)

Session Classification: Sessioni parallele

Track Classification: A6.2 Photons

Contribution ID: **4** Type: **not specified**

Spontaneous Parametric Down-Conversion Beaming from a Lithium Niobate Nanostructured Resonator

Thursday, 6 February 2025 09:45 (15 minutes)

We report the design and fabrication of lithium niobate nanostructured resonators for enhancement and directional beaming of spontaneous parametric down-conversion photons. Preliminary measurements achieved photon-pair production rates up to 300 Hz/W at telecom wavelengths.

Presenter: ZILLI, Attilio (POLIMI)

Session Classification: Sessioni parallele

Track Classification: A6.2 Photons

Contribution ID: **5** Type: **not specified**

Quantum Dot intersubband Photodetectors for LWIR photons

Thursday, 6 February 2025 10:00 (15 minutes)

Intersubband photodetector for LWIR photons based on resonant state absorption in quantum dots shows absorption up to room temperature thanks to the enhanced extraction efficiency without sacrificing the absorption probability.

Presenter: VICHI, Stefano

Session Classification: Sessioni parallele

Track Classification: A6.2 Photons

Contribution ID: **6** Type: **not specified**

Optical Forces and Field Dynamics in Gain-Enhanced Plasmonic Nanostructures: Toward Single-Particle Nanolasers

Thursday, 6 February 2025 10:15 (15 minutes)

We study optical forces and trapping of hybrid quantum-plasmonic nanoparticles with a metal nanoshell and a gain-enriched core, below and above the emission threshold.
This open perspectives for single-particle nanolaser with potential for quantum-enhanced plasmonics.

Presenter: VELTRI, Alessandro (CNR ICPF Messina)

Session Classification: Sessioni parallele

Track Classification: A6.2 Photons

Contribution ID: **7** Type: **not specified**

Employing Nanotechnology: Improving Solar Cell Performance by Integrating Quantum Dots and Gold Nanoparticles

Thursday, 6 February 2025 10:30 (15 minutes)

An optimization study of dye-sensitized solar cells (DSSCs) enhanced power conversion efficiency by integrating gold nanoparticles into a TiO2 semiconductor and refining particle sizes, leveraging the unique properties of noble metal nanostructures for improved performance.

Presenter: CITRO, Ilaria (CNR)

Session Classification: Sessioni parallele

Track Classification: A6.2 Photons

Contribution ID: **8** Type: **not specified**

High-Q cavity coupled to a high permittivity dielectric resonator for sensing applications

Thursday, 6 February 2025 10:45 (15 minutes)

We report on coupled cavity configurationin whith high Q-factor elliptical TESLA-shaped superconducting cavity is coupled with a high permittivity (εr) SrTiO3 puck measured down T=0.2K. Extensive electromagnetic simulations are used to test different coupling configurations.

Presenter: CASSINESE, Antonio (UNINA)

Session Classification: Sessioni parallele

Contribution ID: **9** Type: **not specified**

Novel phenomena in oxide two-dimensional electron systems

Thursday, 6 February 2025 11:30 (15 minutes)

I will present results about oxide two-dimensional electron systems (2DES) characterized by functional properties engineered by epitaxy. I will show that 2DES with multiple coexisting order parameters can be designed and realized using this approach.

Presenter: SALLUZZO, marco (CNR-SPIN)

Session Classification: Sessioni parallele

Track Classification: A6.3 Electrons

Contribution ID: **10** Type: **not specified**

Anomalous magneto-transport of Dirac-like fermions in a spin-polarized oxide two-dimensional electron system

Thursday, 6 February 2025 11:45 (15 minutes)

We present anomalous magneto-transport dominated by non-trivial Berry curvature and Dirac-like fermions exhibited by artificial 2DES at (111) LaAlO3/EuTiO3/SrTiO3 interface, where structural and electronic properties are tailored to mimic that of magnetic gapped topological insulators.

Presenter: CHEN, Yu (CNR SPIN Napoli)

Session Classification: Sessioni parallele

Track Classification: A6.3 Electrons

Contribution ID: **11** Type: **not specified**

Characterization and performances of the first NbSe2 qubit

Thursday, 6 February 2025 12:00 (15 minutes)

We present the experimental results obtained by measuring the performances of a NbSe2 qubit.

Presenter: D'ELIA, Alessandro (INFN LNF)

Session Classification: Sessioni parallele

Track Classification: A6.3 Electrons

Contribution ID: **12** Type: **not specified**

Development and Analysis of Transmon Qubits: Design, Simulation, and Characterization

Thursday, 6 February 2025 12:15 (15 minutes)

We investigated simulation techniques for superconducting transmon qubits, comparing their predictions with experimental results. The promising agreement observed highlights the potential of these methods to guide the design of qubits for quantum sensing applications.

Presenter: LABRANCA, Danilo (UNIMIB)

Session Classification: Sessioni parallele

Track Classification: A6.3 Electrons

Contribution ID: **13** Type: **not specified**

Development of a Custom Superconducting Qubit Control and Readout System

Thursday, 6 February 2025 12:30 (15 minutes)

We investigate the use of Radio-Frequency System on Chip (RFSoC) FPGA boards to build a custom control system for superconducting qubits control. RFSoC boards offer the benefits of being cost-efficient,
compact, and fully configurable.

Presenter: CAROBENE, Rodolfo (UNIMIB)

Session Classification: Sessioni parallele

Track Classification: A6.3 Electrons

Contribution ID: **14** Type: **not specified**

Integration of overlap Al/Al-Ox/Al Josephson junctions in superconducting quantum circuits: from transmon qubits to novel devices

Thursday, 6 February 2025 12:45 (15 minutes)

We developed scalable, state of the art overlap Al/Al-Ox/Al Josephson junctions for quantum applications, including transmon qubits and a novel cryogenic on-chip microwave frequency shifter.

Presenter: IRACE, Alessandro (UNIMIB)

Session Classification: Sessioni parallele

Track Classification: A6.3 Electrons

Contribution ID: **15** Type: **not specified**

Controlling and calibrating quantum devices using the open-source framework Qibo

Thursday, 6 February 2025 13:00 (15 minutes)

We present Qibo, an open-source quantum computing framework offering a full-stack solution for efficient deployment of quantum algorithms and calibration routines on quantum hardware.

Presenter: CARRAZZA, Stefano (UNIMI)

Session Classification: Sessioni parallele

Track Classification: A6.3 Electrons

Contribution ID: **16** Type: **not specified**

Spoke 6-7 From Integration to Complete Quantum Systems

Wednesday, 5 February 2025 17:40 (30 minutes)

Activities on the SUPERCONDUCTING PLATFORM

Presenter: MANTEGAZZINI, Federic (FBK)

Session Classification: Sessioni plenarie

Contribution ID: **17** Type: **not specified**

Quantum Collective States in Superconducting 5-Qubit Network

Thursday, 6 February 2025 13:15 (15 minutes)

Quantum Collective States in Superconducting 5-Qubit Network

Presenter: RUGGIERO, Berardo (ISASI CNR)

Session Classification: Sessioni parallele

Track Classification: A6.3 Electrons

Contribution ID: **19** Type: **not specified**

Development of 3D superconducting Qubit

Friday, 7 February 2025 09:00 (15 minutes)

3D architectures with superconducting qubits are very attractive solutions for several quantum applications. We report here our recent progress in design and fabrication of such devices and in their characterization.

Presenter: TOCCI, Simone (INFN LNF)

Session Classification: Workshop tematici

Track Classification: A6.4 Hybrids

Contribution ID: **20** Type: **not specified**

Development of SC cavities for qubits and quantum memories

Friday, 7 February 2025 09:15 (15 minutes)

3D architectures with superconducting qubits are highly attractive solutions for various quantum applications. We report our recent progress in the design, fabrication, and surface preparation of superconducting cavities, achieving significant quality factor (Q) increase.

Presenter: CHYHYRYNETS, Eduard (INFN LNL)

Session Classification: Workshop tematici

Track Classification: A6.4 Hybrids

Contribution ID: **21** Type: **not specified**

Advancing Kinetic Inductance Traveling Wave Parametric Amplifiers for Quantum Technologies

Friday, 7 February 2025 09:45 (15 minutes)

We present the current progress towards a rapid simulation and design framework for KI-TWPAs and examples of its use, such as the development of a novel frequency converter-amplifier device.

Presenter: CAMPANA, Pietro (UNIMIB)

Session Classification: Workshop tematici

Track Classification: A6.4 Hybrids

Contribution ID: **22** Type: **not specified**

Coherent states detection for light dark matter searches using multi-qubit sensor

Friday, 7 February 2025 09:30 (15 minutes)

The development of superconducting quantum devices has enabled advancements in quantum sensing, particularly for light-dark matter searches. We propose an enhanced detection scheme leveraging multiple qubits to reduce dark-count rates.

Presenter: GOBBO, Marco (UNIMIB)

Session Classification: Workshop tematici

Track Classification: A6.4 Hybrids

Contribution ID: **23** Type: **not specified**

Development of superconducting high kinetic inductance devices

Friday, 7 February 2025 10:00 (15 minutes)

Development of superconducting high kinetic inductance devices

Presenter: AHRENS, Felix Klaus (FBK & CNR-IFN)

Session Classification: Workshop tematici

Track Classification: A6.4 Hybrids

Contribution ID: **24** Type: **not specified**

Design and modelling of practical JTWPA

Friday, 7 February 2025 10:15 (15 minutes)

The current status of development of practical and reliable Josephson junctions-based traveling wave parametric amplifiers (JTWPA) for qubit integration and readout is reported.

Presenter: PAGANO, Sergio (UNISA)

Session Classification: Workshop tematici

Track Classification: A6.4 Hybrids

Contribution ID: **25** Type: **not specified**

Photon-number resolution with Transition-Edge Sensors

Friday, 7 February 2025 10:30 (15 minutes)

Project STAR develops TiAu TES single-photon detectors with photon-number resolution, with the goal to achieve >90% detection efficiency and 1 μs response time. Results on TESs with gold banks and antireflection coatings are presented

Presenter: MALNATI, Federico (INRIM)

Session Classification: Workshop tematici

Track Classification: A6.4 Hybrids

Contribution ID: **26** Type: **not specified**

Low power microwave photon detector based on Superconducting Qubit Network

Friday, 7 February 2025 10:45 (15 minutes)

We have carried out a comparison between novel theoretical approach and experiments on quantum collective dynamics of superconducting qubit network (SQN) embedded in microwave planar resonators.

Presenter: LISITSKIY, Mikhail (SPIN-CNR)

Session Classification: Workshop tematici

Track Classification: A6.4 Hybrids

Contribution ID: **27** Type: **not specified**

Indium Phosphide Monolithical Integration of a Photonic Source Device Independent Quantum Random Generator

Friday, 7 February 2025 09:00 (15 minutes)

We report the fabrication of a monolithically integrated QRNG with an Indium Phosphide platform. The device offers a better level of security than fully-trusted systems, with a predicted secure generation rate > 13.3984 Gb/s

Presenter: DE MARINIS, Lorenzo (SSSA)

Session Classification: Workshop tematici

Track Classification: A6.2 Photons

Contribution ID: **28** Type: **not specified**

Pump-driven optical Kerr rotation and hidden quantum entanglement in centrosymmetric bulk WSe2

Friday, 7 February 2025 11:30 (15 minutes)

We report on the observation of an ultrafast pump-driven Kerr rotation in centrosymmetric bulk WSe2. We rationalize these findings as result of the hidden entanglement among several qauntum degrees of
freedom

Presenter: CAPPELLUTI, Emmanuele (Istituto di Struttura della Materia (ISM), CNR, Trieste)

Session Classification: Workshop tematici

Track Classification: A6.2 Photons

Contribution ID: **29** Type: **not specified**

Quantum Correlated Twin Beams in Cascaded Quadratic Processes

Friday, 7 February 2025 11:45 (15 minutes)

Twin beams are observed in an optical resonator where cascaded second harmonic generation and optical parametric oscillation occur. We measure a squeezing level up to -5 dB in their intensity difference.

Presenter: RICCIARDI, Iolanda (CNR-Istituto Nazionale di Ottica)

Session Classification: Workshop tematici

Track Classification: A6.2 Photons

Contribution ID: **30** Type: **not specified**

Ultracompact entangled photon sources based on 2D semiconductors

Friday, 7 February 2025 09:45 (15 minutes)

Here we realize ultracompact entangled photon sources by periodically poling 2D semiconductors (3R-MoS2), demonstrating quasi-phase-matched up- and down-conversion over micron-thick pathlengths.

Presenter: TROVATELLO, Chiara (POLIMI)

Session Classification: Workshop tematici

Track Classification: A6.2 Photons

Contribution ID: **31** Type: **not specified**

Kinetic Inductance Traveling Wave Parametric Amplifiers for Practical Microwave Readout

Friday, 7 February 2025 11:45 (15 minutes)

Superconducting quantum systems and fundamental physics experiments demand amplifiers with large bandwidth and noise to the quantum limit. We present Kinetic Inductance Traveling-Wave Parametric Amplifiers, designed to enhance qubit and detector readout with improved performance.

Presenter: GIACHERO, Andrea (University of Milano-Bicocca)

Session Classification: Workshop tematici

Track Classification: A6.4 Hybrids