High Performance Computing and Quantum Computing – Seventh Edition

Daniele Ottaviani[1], Enrico Prati[2], Luca Nigro[2],

Paolo Zentilini[2], Sara Marzella[1], Anita Camillini[1], Vito Palmisano[1]

HPCQC Organizing Committee
[1] CINECA – Consorzio Interuniversitario   [2] University of Milan

Day One: 12/12/2024

09:30 – 10:20   **Registration**

10:20 – 10:30   Emilia-Romagna Region
Bologna's Technopole
10:30 – 10:45   Sanzio Bassini – CINECA
Welcome
10:45 – 11:30   Ivano Tavernelli – IBM Quantum
Keynote – *Quantum computing in the utility era*
11:30 – 11:50   Daniele Ottaviani – CINECA
Quantum Computing Lab Update

Session 1: CINECA partners for Quantum Computing – Chairperson: Daniele Ottaviani

11:50 – 12:15   Hermanni Heimonen – IQM
IQM Radiance – the quantum computer for HPC centers
12:15 – 12:40   Vincent Martin – Pasqal
Presentation of Pasqal quantum computer: from neutral atoms to use cases
12:40 – 13:05   Axel Daian – D-Wave
Quantum Computing for Practical Applications

13:05 – 15:00   **Lunch + Tour of the Technopole**

Session 2: QC Made in Italy I – Chairperson: Sara Marzella

15:00 – 15:25   Giacomo Cappellini – Eniquantic
Eniquantic: Eni's New Venture Towards the Future of Quantum Computing
15:25 – 15:50   Francesco Tafuri – University of Naples Federico II
Superconducting hardware of a quantum computer: physics, implementation, operation and perspectives
15:50 – 16:15   Simone Cialdi – University of Milan
TQ4C - a loop-architecture photonic quantum computer

16:15 – 16:35   **Coffee Break**

Session 3: QC Made in Italy II – Chairperson: Anita Camillini

16:35 – 17:00   Roberto Osellame – Ephos Inc./CNR
Integrated quantum photonic processors, a path toward a photonic quantum computer
17:00 – 17:25   Fabio Sciarrino – University of Rome "Sapienza"
Photonics platform for quantum computing: hardware and applications
17:25 – 17:50   Roberto Siagri – Rotonium
Edge-Centric Quantum Computing: The Next Frontier
17:50 – 18:15   Daniel Szombati – Planckian
A globally-driven superconducting quantum computing architecture

Day Two: 13/12/2024

Session 4: Universities and Research Centers I – Chairperson: Enrico Prati

09:30 – 09:50   Lorenzo Pisani – CRS4
Vehicle Routing Problems (VRP) for urban transport applications solved by means of adiabatic quantum computers
09:50 – 10:15   Domenico Bonanni – University of L'Aquila
Molecular Structure Generation and Docking with Quantum Computing
10:15 – 10:50   Rebecca Casati – University of Milan
Adiabatic Quantum Computing and Hybrid quantum-classical methods for Job Shop Scheduling problems

10:50 – 11:10   Coffee Break

11:10 – 11:35   Antonio Policicchio – NTT DATA
Application of variational circuits to a Soft Actor-Critic framework for continuous control tasks
11:35 – 12:00   Elisabetta Boella – E4
SmartHPC.QC: evaluating the impact of malleability for HPC-QC integration
12:00 – 12:25   Vito Palmisano – CINECA/ParTec
High-Performance Quantum Emulation: Benchmarking Statevector and Tensor Network Emulators on Leonardo and Introducing QMatchaTEA's Capabilities
12:25 – 12:50   Francesco Monzani – University of Milan
Leveraging non-unital noise for gate-based quantum reservoir computing

12:50 – 14:00   Lunch

Session 5: Universities and Research Centers II – Chairperson: Paolo Zentilini

14:00 – 14:25   Francesco Turro – Leonardo Labs
Solving Fluid dynamics on a quantum computer
14:25 – 14:50   Leonardo Guidoni – University of L'Aquila
Quantum Information and State preparation in Quantum Chemistry
14:50 – 15:10   Michele Vischi – University of Trieste
Simulating photonic devices with noisy optical elements
15:10 – 15:35   Giorgio Panichi – University of Milan
Embodiment of quantum physics informed neural networks to solve differential equation over a continuous-wave quantum computer
15:35 – 15:55   Emiliano Poli – University of Padua
Performance assessment of different Variational Quantum Eigensolver algorithms via Matrix Product States powered quantum computer emulator

15:55 – 16:15   Coffee Break

Session 6: Universities and Research Centers III – Chairperson: Luca Nigro

16:15 – 16:40   Paolo Zentilini – University of Milan
Emulation of QAOA via graph neural networks
16:40 – 17:00   Federico Gallina – University of Padua
Simulating Non-Markovian Dynamics in Multidimensional Electronic Spectroscopy via Quantum Algorithm
17:00 – 17:20   Domenico Del Prete – University of Naples Federico II
An Interoperability Middleware between Two Computing Universes: HPC and Quantum Computing (HPC-QC)
17:20 – 17:40   Gianluca Teza – Max Planck Institute for the Physics of Complex Systems
Finite temperature criticality in a quantum annealer
17:40 – 18:00   Marco De Pascale – LRZ
Benchmarking QC simulators on HPC systems: results