



Finanziato  
dall'Unione europea  
NextGenerationEU



Ministero  
dell'Università  
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PIANO NAZIONALE  
DI RIPRESA E RESILIENZA



# NQSTI

## The National Quantum Science and Technology Institute



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# NQSTI

## e la partecipazione italiana alla Call QuantERA 2023

The **National Quantum Science and Technology Institute** is a consortium that will

- I. team up Italian entities carrying out competitive and innovative research in QST,
- II. stimulate future industrial innovation in this field,
- III. provide a forum in which novel ideas and opportunities are transferred to companies,
- IV. favor successful Italian participation to European and international programs.

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**Countries participating in the Call:**

Austria, Belgium, Bulgaria, Canada, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Hungary, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom.



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The whole innovation chain is considered: **from the strengthening and coordination** of the low-TRL research, **to its translation into prototypes**, favoring **interfacing with industrial needs** thanks to outreach and **continued-education programs**. Importantly, the creation and incubation of **spin-offs and start-ups** that can move research outcomes up in the TRL-ranking are included in the proposal scope with significant resources and a special focus onto the southern regions.

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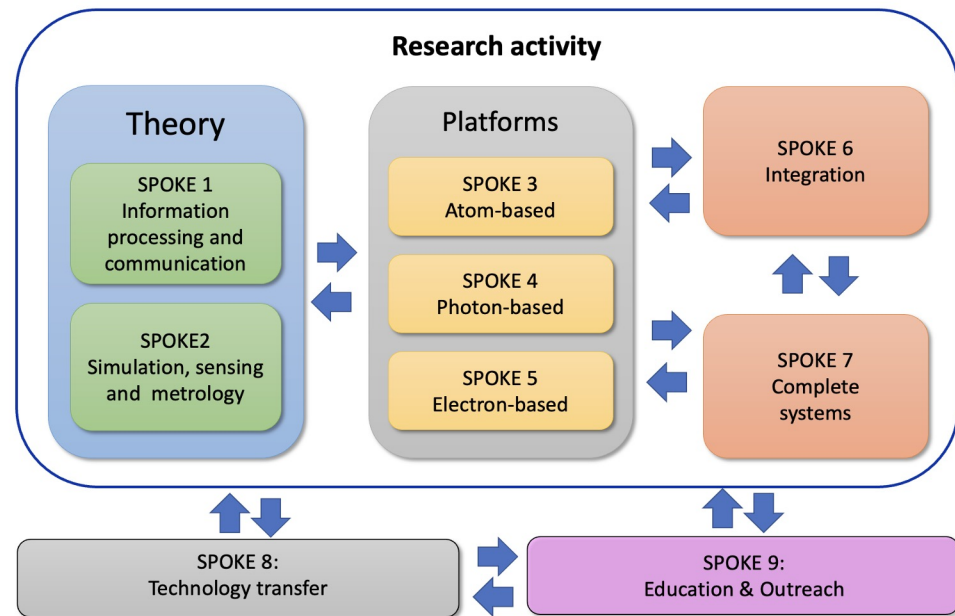
The format of the present call did not make it possible to include in the project activities all the teams that can contribute to our vision for NQSTI. We selected the project participants as the most qualified in the country by considering the balance in their specializations and their readiness to contribute to project goals. Importantly, we **earmarked significant funding to support a number of highly-focused open calls** that we believe will allow us to gather all the available expertise and ensure the maximum efficacy of the project stimulating and synergizing Italian research in QST.

## Hub

- società consortile con sede a Roma presso il CNR
- *possono* essere soci tutti i partecipanti al progetto e i vincitori dei bandi a cascata

## Spoke

1. Università di Pavia
2. Università di Camerino
3. Consiglio Nazionale delle Ricerche
4. Università di Roma Sapienza
5. Scuola Normale Superiore
6. Università di Milano Bicocca
7. Fondazione Bruno Kessler
8. Consiglio Nazionale delle Ricerche
9. Università di Catania



## A. QST Theoretical Foundations and Novel Paradigms

The development of QST requires sound and comprehensive theoretical research, which is pivotal to advancing the knowledge of quantum information science and physical systems as well as to designing new devices and implementing new quantum protocols for applications at the industrial level

1. Fundamental concepts of quantum information theory that transcend specific implementation platforms.
2. Theory of quantum information processing and communication in the chosen platforms
3. Quantum complexity in quantum matter and devices searching emerging collective phenomena of interest for quantum information purposes
4. Investigation of the energetic aspects of quantum technologies



## B. Technology Platforms for QST

Conceptual paradigms proposed in part A. must be translated into physical implementations by taking advantage of the most suitable quantum platforms available.

The quantum toolbox NQSTI supports:

1. Atom and molecule-based implementations
2. Photon-based implementations
3. Electron-based, solid-state implementations

## C. Integration, System Architectures

Integration of individual quantum objects into devices and modules with the general scope of

- i) engineering scalable quantum components and devices,
- ii) developing new high-fidelity device read-out and control,
- iii) increasing the number of interacting quantum devices and components in a single module,
- iv) developing components that allow for close-to-room-temperature applications.

Particular attention is given to the development and test of complete systems in the laboratory for specific research activities of relevance in the areas of

- a. quantum imaging,
- b. quantum point sensing,
- c. quantum communication and IoT, and
- d. quantum-simulator systems.