

PHYSICS

INRiM - Advanced metrology in physics (1)

Funded By	I.N.R.I.M. - ISTITUTO NAZIONALE DI RICERCA METROLOGICA [Piva/CF:09261710017]
Supervisor	BUFALINO STEFANIA - stefania.bufalino@polito.it
Contact	Marco Pizzocaro (m.pizzocaro@inrim.it) Francesca Durbiano (f.durbiano@inrim.it) Eleonora Cara (e.cara@inrim.it) BARBIERO LUCA - luca.barbiero@polito.it Federico Ferrarese Lupi (f.ferrareselupi@inrim.it) SANTARELLI MASSIMO - massimo.santarelli@polito.it Carlo Sias (c.sias@inrim.it) COSTANZO GIOVANNI ANTONIO - giovanni.costanzo@polito.it LAMBERTI ANDREA - andrea.lamberti@polito.it
Context of the research activity	This Thematic Grant includes 4 research Topics (listed below), with a specific title and proponent Supervisor/s. The applicants have the possibility to identify the specific topic they are interested in. Topic 1: Development of a Yb Optical Clock for International Comparisons. Topic 2: Development of certified reference materials of CO₂ gas mixtures characterized for the isotopic composition by developing on purpose physical measurements. Topic 3: Developing a Scalable Quantum Network of Trapped Ions. Topic 4: Operando small-angle x-ray scattering analysis of nanostructured materials for energy storage. For more details about the Topics, visit: https://www.inrim.it/en/services/training/early-career-metrology/phd-scholarships
Objectives	Topic 1: Developing a high-precision optical atomic clock at INRiM for advanced metrology, with applications in SI second redefinition, space tech, and international clock comparisons. Topic 2: CO₂ gas mixture preparation and uncertainty evaluation. Stability studies by CRDS and FTIR spectroscopies. Measurement comparison. Protocol and measurement system setup for field measurements. Topic 3: The objective is to build a quantum network of trapped ions for distributed quantum computing architectures. This will be realized by entangling two distant Ba⁺ ions by using a photonic network. Topic 4: This PhD thesis is focused on the characterization by small-angle x-ray scattering of nanostructured materials (e.g. porous silicon and self-assembled) applied to Energy Storage.

**Skills and
competencies
for the
development of
the activity**

Topic 1: Background in atomic/laser/quantum physics or optics can be useful, but the candidate will have the chance to fill initial gaps during the activity.

Topic 2: Master degree in Physics, Chemistry, Industrial Chemistry, Chemical and Sustainable Processes Engineering. Background in spectroscopic techniques, analytical analysis, and basic knowledge in metrology.

Topic 3: Learning drive is paramount. Competencies will be developed in: laser operation, data analysis, basic electronics, UHV technology, and finite element software for simulation.

Topic 4: Basic knowledge of solid-state physics and x-ray analysis.