PHYSICS

INRiM - Advanced metrology in physics

Funded By	I.N.RI.M. - ISTITUTO NAZIONALE DI RICERCA METROLOGICA [P.iva/CF:09261710017]
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Context of the research activity	This Thematic Grant includes 6 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. The research activity will be carried out in Turin. -Topic 1: Engineering quantum states in hybrid atom-cavity coupled systems for quantum enhanced metrology - Topic 2: Memristive self-organizing dendrite networks for brain-inspired computing - Topic 3: Development of a Yb Optical Clock for International Comparisons - Topic 4: Heat flux sensors based on Nernst effects - Topic 5: A chip-scale ultra-precise atomic clock - Topic 6: Development and characterization of plasmonic gas sensing devices with integrated microporous gas-storage layer For more details about the Topics, visit: https://www.inrim.it/en/services/training/early-career-metrology/phd-scholarships
Objectives	- Topic 1: Study hybrid atom-cavity systems with ultracold strontium for quantum-enhanced optical clocks. Explore spin squeezing, superradiance, and non-classical states for advancements in metrology and sensing. - Topic 2: The PhD project, that lies at the crossroad of nanotechnology, physics, material sience and machine learning, aim to develop novel hardware architectures based on dendrites for neuromorphic computing. - Topic 3: 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 4: This PhD program focuses on Nernst effects in magnetic and semi-

	metallic materials, in the field of fundamental physics and material sciences, for the development of transverse thermoelectric devices. - Topic 5: Develop low-noise optoelectronics for laser manipulation, atom interrogation, and optical-to-microwave conversion, to realise a chip-scale ultra-precise atomic. - Topic 6: Develop gas sensors for CH4/CO2 in ppm-ppb range through integrated synthesis of microporous gas storage, studying the pysics and modeling and microfabrication of plasmonic structures, characterization via FTIR and Raman.

Skills and competencies for the development of the activity	- Topic 1: Scientific skills: Quantum mechanics, Optics, Electronics, Data analysis. Favorite computer skills: basic knowledge of Python. Latex. - Topic 2: The ideal candidate is familiar with chemical and physical processes, basic programming and basic machine learning concepts. - Topic 3: 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 4: A scientific master's degree is required (physics, chemistry) and a good attitude for experimental research, ranging from the preparation of materials to the development of new measurement systems. - Topic 5: Background in photonics, microwave electronics or digital electronics can be useful, but the candidate will have the chance to fill initial gaps during the activity. - Topic 6: MS in Chemistry, Materials Science, Physics or Engineering / Good written and oral English / Experience in either materials synthesis, FEM simulations, microfab, FTIR, Raman spectroscopy or plasmonics.