

Two decades of Quantum Science through the lens of a photonics institute

A new article in Revista Brasileira de Ensino de Fisica tells the story of ICFO in quantum science since its inception. It highlights the main achievements in quantum correlations and Bell inequalities, quantum communications and cryptography, quantum simulation, quantum sensing and metrology, and quantum materials, as well as their impact in the global quantum ecosystem.

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When ICFO (the Institute of Photonic Sciences, Barcelona, Spain) was founded in 2002, quantum technologies were still in their infancy, with quantum mechanics mostly confined to fundamental research. Key questions remained about the nature of quantum correlations, the feasibility of practical quantum communication, and the potential of quantum-enhanced sensing.

Over the past two decades, ICFO has played an important role in advancing quantum

science, bridging fundamental discoveries with real-world applications.
ICFO's early work in quantum correlations, such as loophole-free Bell tests and device-independent randomness, has deepened the understanding of entanglement and boosted secure quantum cryptography. In quantum networks, ICFO has pioneered quantum memories and entanglement distribution for long-distance communication.
The institute has been at the forefront of topological physics and quantum simulation, advancing ultracold atom engineering and providing insights about lattice gauge theories, and has also played a key role in quantum nanophotonics, and in advancing quantum dots, graphene, and 2D materials.
Additionally, ICFO has developed interaction-based quantum sensing techniques in magnetometry, surpassing classical precision limits.
These innovations have not only pushed the boundaries of fundamental quantum physics but have also fostered a major industrial impact, leading to the commercialization of quantum technologies in cryptography, sensing, photonics, and soon, photonic chips.
Laia Serradesanferm Cordoba, staff Science Writer at ICFO, and **Dr. Robert Sewell**, Vice Director of People, Education and Culture at ICFO, have now published an article in Revista Brasileira de Ensino de Fisica, where they provide an overview of ICFO's most significant achievements in quantum science since its inception, highlighting its central role in shaping the modern landscape of quantum research and technology, going through all the details in the aforementioned areas.

Reference:
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