

FET-OPEN QUROPE – Quantum Repeaters using On-demand Photonic Entanglement



DIPARTIMENTO DI FISICA

SAPIENZA

Università di Roma

Rinaldo Trotta

WEBINAR "EUROPEAN INNOVATION COUNCIL - EIC: OPPORTUNITÀ DI FINANZIAMENTO PER LA RICERCA INNOVATIVA"



4 MARZO 2021



BACKGROUND: COMMUNICATION SECURITY

Our communication system is vulnerable to un-wanted attacks

Quantum Cryptography

For long-distances: Quantum repeaters

QUANTUM REPEATERS



Gisin, Nat. Phot. <u>2007</u>: "Despite **some claims**, nothing like this has been demonstrated so far and one should not expect any real-world demonstration for another <u>5-10 years</u>."

McMahon and De Greve, Springer 2014: "Seven years later, much the same can still be said"

Trotta, EIC-WEBINAR-Sapienza <u>2021</u>: "Keep working..."

Main roadblock: Suitable technology

QUANTUM REPEATERS



Artificial and natural atoms





Technology is (almost) ready



OUR VIEW: TECHNOLOGY IS ALMOST READY, EITHER NOW OR NEVER!



MAIN QUESTION: ARE WE CREDIBLE? The idea is not really new...

OUR APPROACH: We understood why previous appraoaches failed, and devised different strategies for the construction of quantum repeaters... only a collaborative effort would make this possible.



THE CORE IDEA OF THE PROJECT

Hybrid Quantum Repeaters



EXPERIENCE AS EVALUATOR HELPS



FET Evaluation criteria

Excellence	Impact	Quality and efficiency of the implementation
 Clarity and novelty of long-term vision, and ambition and concreteness of the targeted breakthrough towards that vision. Novelty, non-incrementality and plausibility of the proposed research for achieving the targeted breakthrough and its foundational character. Appropriateness of the research methodology and its suitability to address high scientific and technological risks. Range and added value from interdisciplinarity, including measures for exchange, crossfertilisation and synergy. 	 Importance of the new technological outcome with regards to its transformational impact on technology and/or society. Impact on future European scientific and industrial leadership, notably from involvement of new and high potential actors. Quality of methods and measures for achieving impact beyond the research world and for establishing European though leadership, as perceived by industry and society. 	 Soundness of the workplan and clarity of intermediate targets. Relevance of expertise in the consortium. Appropriate allocation and justification of resources (personmonths, equipment).
Threshold: 4/5, Weight: 60%	Threshold: 3.5/5, Weight: 20%	Threshold: 3/5, Weight: 20%



PROJECT

STRONG POINTS:

Our approach to quantum repeaters. The consortium. **WEAK POINT**: Novelty of the approach. We decided not to hide this point in the proposal!

- The idea of a quantum repeater is not new. The current proposal is mainly based on a theoretical work from 2001. This does not mean that the technological implementation is not novel. Now is just the right time to combine the efforts of researchers working on the development of efficient single-photon sources with researchers working on quantum memories. This is the novelty here.

- The consortium as a whole is extremely strong, many of the PIs are at the top of their research fields. There is the additional benefit of an unfounded US partner...The consortium contains SMEs which is a perfect example of how excellence in science can be translated into a business

PANEL COMMENTS

...Although this vision itself **is not new**, the proposed science-enabled **disruptive technology** will allow the realization of efficient on-demand quantum repeaters and thus **will radically change the performance of quantum communication**.

QUANTUM LINK AT SAPIENZA



To appear in Science Advances in March 2021



Thank you for your attention

