Entanglement restoral with fast photonic circuits

Fact Sheet

Project Information

EReFaPhoc

Grant agreement ID: 101106271

DOI
10.3030/101106271

Project terminated on 23 July 2024

EC signature date
2 May 2023

Start date
1 September 2024

End date
31 August 2026

Funded under
Marie Skłodowska-Curie Actions (MSCA)

Total cost
No data

EU contribution
€ 173 847,36

Investment in EU policy priorities

Digital agenda	◐	Clean air	◐
Artificial Intelligence	◐	Climate action	◐
Biodiversity	○		

Coordinated by
UNIVERSITAET PADERBORN
Germany

Objective

The world is currently on the verge of a new technological revolution, rooted on the possibility of harnessing unique properties of quantum mechanics such as entanglement to implement novel paradigms for computation. Semiconductor quantum dots are excellent candidates to become the sources at the heart of future photonic quantum technologies due to their capability of emitting single and even

entangled photons. However, the presence of a fine structure splitting (FSS) between the excitonic levels significantly degrades the quality of the entangled emission from quantum dots and causes the latter to emit random entangled states instead of always the same Bells one: this pervasive problem has proved to be a major hindrance and prompted significant efforts to devise mitigation strategies.
All the approaches implemented so far assume that, in order to prevent the degradation of entangled photon emission, its prime cause, the fine structure splitting of the source, should be removed. Several approaches have yielded excellent results in this sense, but at the cost of unwanted side-effects or increases in fabrication complexity and introduction of additional challenges for photonic integration.
I propose to implement a complete paradigm shift in the search for a solution to this problem and show that entanglement restoral can be achieved after the emission of the photons from the source: as the latter emits a statistical mixture of entangled states when an FSS is present, and entanglement is not destroyed on a fundamental level, entanglement restoral can in principle be achieved by applying a sequence of logic gates that transforms any component of the ensemble to the same Bell state.
I propose to implement this approach and show its superiority for integrated quantum photonics by developing the worlds first fast photonic circuit in a Lithium Niobate platform designed to manipulate polarization-entangled photons, and fully integrate a quantum dot on the photonic chip.

Fields of science (EuroSciVoc)

natural sciences > chemical sciences > inorganic chemistry > **alkali metals**

social sciences > political sciences > political transitions > **revolutions**

natural sciences > physical sciences > electromagnetism and electronics > **semiconductivity**

natural sciences > physical sciences > theoretical physics > particle physics > **photons**

Programme(s)

HORIZON.1.2 - Marie Skłodowska-Curie Actions (MSCA) MAIN PROGRAMME

Topic(s)

HORIZON-MSCA-2022-PF-01-01 - MSCA Postdoctoral Fellowships 2022

Call for proposal

HORIZON-MSCA-2022-PF-01

See other projects for this call

Funding Scheme

HORIZON-TMA-MSCA-PF-EF - HORIZON TMA MSCA Postdoctoral Fellowships - European Fellowships

Coordinator

UNIVERSITAET PADERBORN

Net EU contribution

€ 173 847,36

Total cost

No data

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Region

Nordrhein-Westfalen > Detmold > Paderborn

Activity type

Higher or Secondary Education Establishments

Links

Contact the organisation Website
Participation in EU R&I programmes
HORIZON collaboration network

Last update: 25 July 2023

Permalink: https://cordis.europa.eu/project/id/101106271