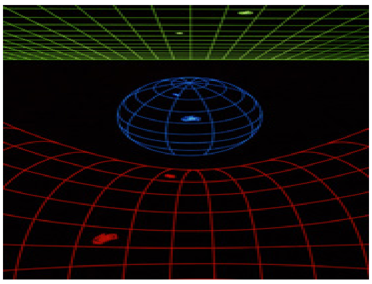
NANOTECHNOLOGY AND MAGNETIC QUBITS TO IMPLEMENT QUANTUM COMPUTATION

Results in Brief

Exploring magnetic qubits for quantum computing

Under the auspices of NANONAGIQC project, researchers investigated the application of nanomagnets, particles and clusters for quantum information processing and storage.

DIGITAL ECONOMY



© PhotoDisc

Unlike most approaches in quantum computing hardware that do not meet all criteria set for realistic implementation, the project focused on developing both new nanodevices and measurement techniques. Based on suitable materials, such as molecular clusters and antiferromagnetic nanoparticles, the magnetic quantum bits, or qubits, were extensively studied as far as their potential for hardware units is concerned.

In order to get a better insight of the qubit behaviour of the magnetic clusters when working as logic gates, the interaction between microwave radiation and magnetic qubits was studied. Within this context, researchers tried to resolve two key issues, which involved the behaviour of our magnetic units as qubits and the superradiance emission.

One of the key issues was the analysis of the electromagnetic radiation accompanying the fast demagnetisation process in molecular magnets. A large variety of different molecular magnets was used in order to correlate the chemical and nuclear properties of the magnetic unit with the probability of radiation emission. Additionally, researchers employed ultra-fast detection methods for the study of the magnetisation change and radiation detection.

Under varying conditions, experiments allowed significant conclusions to be drawn on the influence of the temperature, magnetic field and number of molecules on the power emission of the electromagnetic radiation. By using a wide range of geometries, diameters, lengths and materials of waveguides, a better correlation of the power transmission with the waveguides was accomplished.

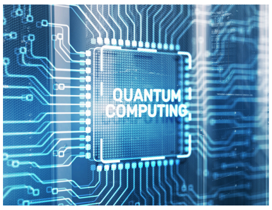
Furthermore, new experiments were conducted for the second key issue, the spin tunnelling transitions in the case of an extremely high sweep of the bias magnetic field. In this case, the experiments displayed that quantum transitions do not adhere to the Landau Zener law as it was originally thought. This is mainly due to the transition of a huge number of spin levels at the same time, which can prove that superradiance emission takes place.

The pioneering research on the interaction of microwave emission and qubits facilitated the development of nanoscale magnetic systems, which is a step forward to European Nanotechnology Information Devices (NID). Most importantly, these NIDs are expected to bridge the gap between conventional IT and the emerging quantum IT.

Discover other articles in the same domain of application

Progressing towards the next-generation cloud-edge-IoT continuum

5 September 2023



[Andreev qubits help lay the groundwork for quantum computer platforms]

4 October 2024

The fighter jet technology swooping into tractors and bulldozers

3 July 2020

Developing crowd-friendly robots

3 June 2022

Project Information

NANOMAGIQC

Grant agreement ID: IST-2001-33186

Project website

Project closed

Start date
1 January 2002

End date
31 December 2004

Funded under
Programme for research, technological development and demonstration on a "User-friendly information society, 1998-2002"

Total cost
€ 2 443 706,00

EU contribution
€ 1 468 000,00

Coordinated by

UNIVERSITAD DE BARCELONA
Spain

Last update: 20 February 2006

Permalink: https://cordis.europa.eu/article/id/82433-exploring-magnetic-qubits-for-quantum-computing