Atom Chip - Improved Methods for Production (BGN)

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Atom Chips are solid state devices used for trapping and manipulating cold neutral atoms. The atom-chip creates a micro-trap for atoms by means of magnetic fields. Generally, the quality of an atom chip operation is characterized by three rates: loss rate, heating rate and decoherence rate. In addition, these rates are dependent on the distance from the atom chip's surface (trap height).

This innovative technology deals with the reduction of the thermally induced magnetic noise arising from the nearby surface. This improvement increases the lifetime of the cold atoms trapped near the surface of the atom chip and allows for enhanced capabilities for quantum technology devices. In addition to increased lifetime, the reduction of the magnetic noise results in decreasing of harmful decoherance and heating effects too.

This magnetic noise reduction is achieved by utilizing special dilute alloys to fabricate the conducting element of the atom chip. In addition, the utilizing of dilute alloys as the conducting elements in the atom chip allows for the monitoring of the relation between noise and resistivity by altering the solute concentration.

Benefits

An enhancement of the quantum phenomena - an increase in the useful life time (time atoms spend in the trap) is achieved by utilizing special alloys as conducting elements and by cooling these elements to a temperature T below room temp. This procedure causes longer coherence times and smaller heating rates thereby enhancing the ability to perform quantum operations that are essential for quantum technology applications in proximity to the chip.
A new degree of freedom - this procedure minimizes the wire resistivity and thereby reduces the Joule heating of the atom chip.
Alloy made wires are less sensitive to temperature variations in space and time when compared to pure metal wires.

Potential Commercial Uses and Strategic Partners

Since the atom chip gives rise to accurate manipulation of the external and internal degrees of freedom of the atom (also known as atom optics), these devices may be adopted for use in a large verity of applications such as: ultra accurate clocks, ultra sensitive gravitation and acceleration sensors, magnetic sensors (e.g. for NDT), quantum cryptography (secure communication) and quantum computing.
Development Stage and Development Status Summary
First proof of concept was achieved theoretically and a prototype is under fabrication development. A first result from this experiment is expected within a year.

Patent Status

Patent pending

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