Quantum Computing Circuits

Case 12MST015

It is a well-documented phenomenon in the computing world that the processing power of computers tends to double every 2 years. While of immense benefit to the consumer, this cycle leads to spiraling research, development and manufacturing costs for the integrated circuit manufacturer. Additionally it has been admitted by industry that trying to produce transistors smaller than 16 nanometers may be impossible. Clearly, traditional manufacturing techniques must be subverted in the near future if chip designs are to keep pace with ever-rising expectations.

The inventive technology uses quantum networks of Aharonov-Bohm (AB) rings that are governed by a set of scaling laws which show transmission and device operation to work identically from the mesoscopic region all the way down to the atomic.

Benefits of Technology

- Analogous to spintronic-based quantum computing, but a much easier extension from the current transistor-based lithographic techniques.
- Demonstrates a half-adder circuit with only two coupled AB rings - a job that takes 16 traditional CMOS transistors.
- This technology is scalable as small as fabrication techniques allow, making it possible to create denser and more powerful integrated logic circuits while sidestepping the problems of other technologies at the sub-nanometer range.

Potential Commercial Applications

The fields of encryption, cryptanalysis, supercomputing, weather prediction and genetic analysis could all benefit from the application of practical quantum computers. From a manufacturer’s standpoint, the need to continue to meet Moore’s law is going to become exponentially more expensive and difficult in the near future using typical transistor designs. This invention demonstrates a viable, more powerful alternative.

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Development Status

Electron Transport Through Two Irreducibly-Coupled Aharonov-Bohm Rings With Applications to Nanostructure Quantum Computing Circuits,