Light Computing

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Abstract

A configuration of light pulses is generated, together with emitters and receptors, that allows computing. The computing is extraordinarily high in number of flops per second, exceeding the capability of a quantum computer for a given size and coherence region. The emitters and receptors are based on the quantum diode, which can emit and detect individual photons with high accuracy.
Traditional computing relies on the movement of electrons through logic circuits. Planned designs for quantum computing \[1\] require the manipulation of wavefunctions through nanocircuitry, and this requires special equipment to manufacture. These two types of circuitries are commonly described in the literature, with emphasis on the latter in its computational power. There is another possibility using an aspect of quantum computing, that is coherence of electrons or photons with each other or themselves. Laser computing requires the coherence of many photons in a manner that short pulses in the overall wavefunction can accomplish the equivalent of a circuit. The concept and several basic architectures are presented.

Laser computing does not require any physical circuits, except the emitters and receptors that are used in the beam configuration. For example, consider a platform half a meter in diameter containing, possibly quantum, diodes emitting a cohered photon shower every picosecond. There would be an approximate $10^{18}$ elements or less in the emitter. Give these diodes an angular precision of $\Delta \theta = 10^{-4} - 10^{-6}$ or more. The second platform is the receptor platform located a distance $d$ meters away. The receptor dish should be able to measure the amplitude and phase of the incoming cohered beam; if the frequencies are required to be measured then their components have to be separated and directed to the appropriate region in the receptor platform. Either that or the receptor elements must distinguish the frequency of the incoming photon. The parameters of the beam, such as the radius and the distance, should be chosen so that the entire beam has coherence with itself over the distance $d$.

The type of quantum diodes that are used in the models are defined as a lattice of a material that has a series of donor atoms in a row which are meta-stable and form a current when a small current is applied. The row of donated electrons are trapped in a meta-stable quantum well near the boundary of the material for a small period of time, where they coher and then escape, emitting a number of cohered photons. The width and depth of the quantum well (trap) dictate the properties of the emitted burst of photons.

Next, cohered beams are placed that crossfire the previous one; this is described in figure 1. The angles and orientation are chosen so as to alter the coherence with each other and the 'primary' beam. Firing photons in patterns, and possibly with differing frequencies, from the various emitters in the emitter platform generate very complex coherence patterns in the primary beam and the secondary beams. Consider ten beams a half meter long with a primary beam three meters. The optimum case should not coher over the maximum and this puts a constraint on the geometry; the considered example is illustrative. The secondary beams can alter the primary beam with an approximate $10^8$ (from the diameter) and maybe $10^4$ during a single cycle.
of the primary beam’s traversing the distance $d$ (if the diode has picosecond timing). Then there are ten beams, and the individual photons from the secondary beam quantum coheres with the entire primary beam. The complexity is overwhelming, and possibly equals or exceeds the concept of a quantum computer. Considering the length $d = 3$ meters the complexity with one secondary beam could be $10^{10^{12}}$, not including self-coherence of the two beams. This grows when the coherence of the secondary beams with themselves and with the other beams are considered.

The coherence length of the lasers should encompass the entire geometry for maximal effect. If the former is smaller than the size of the system, degradation of the photon coherence occurs.

A different configuration consists of a primary beam along an axis of a sphere. Diodes are placed for maximal packing along the inner wall of the sphere. This might lead to maximal coherence of the beam with the sphere’s diodes. Firing the diodes in various patterns would coher the beam in various ways, generating a very fast quantum computer.

A small set of beams with receptors and emitters can be used also in an arrangement of a lattice, such as a bipartite diamond configuration, that fits in a box on your desk, the size of a computer. It would be encased in a material so that coherence with the outside is minimized. The emitters and receptors span a smaller area. A secondary fast chip can be used to pattern the emitters.

The configuration of laser beams requires much accuracy and stability to ensure its quantum coherence as designed. A question is whether the laser computing is more stable than a nano-sized circuit that captures the wavefunction of an electron.
Figure 2: A spherical arrangement. The little circles are the diode emitters and the tube is the primary beam.

in a complicated environment.

One difficulty in programming the cohered laser computing involves the apparent non-linear sequence of interference terms in the cohered system (such as the secondary beams or the sphere of diode light emitters) and their timing. A second difficulty is in the memory allocation; one of the beams or a backup chip could be used for memory allocation in the role of a cache or larger memory designation with longer lifetime.

The beam configurations in the laser computing appear to generate computing with flops per second with extremely large numbers of digits. The architecture is an alternative to the conventional definition of a quantum computer. Also the core of the computing doesn’t involve nano-circuitry.

There exists much coherence stability protection not mentioned in this article, Jan 2006.
References

[1] Richard P. Feynman, “Quantum Mechanical Computers,” Plenary talk given at IQEC-CLEO Meeting, Anaheim, CA, Jun 19, 1984. In *Brown, L.M. (ed.): Selected papers of Richard Feynman* 968-992.