Graphene Quantum Dots for Quantum GPU architectures.

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Abstract:
This paper is on a quantum architecture using the Display Computing paradigm, for a Quantum GPU design. It builds on my previous work on quantum reconfigurable computing. The design builds on a generalized 10 qubit architecture that can be reconfigured to provide display stream and input stream transformation using quantum computing.

Keywords: Quantum GPU, Stream Processors, CUDA architectures, Graphene Quantum Dots

Introduction.

Quantum processors have been developed for several niche applications, the latest being Bristlecone by Google which is a 70 qubit architecture. Quantum GPU's are still on the design board, with several organizations designing graphics acceleration architectures using quantum computing(Caraiman and Manta 2009; Meredith et al. 2009; Benedek and Caglioti 2019; Peruš and Mitja 2010; Cawkwell et al. 2012; Lanzagorta and Uhlmann 2005).

The need for Quantum GPU's

We are designing QGPU's with a target application to mobile tablet applications with integrated classical/quantum computing with SaaS/cloud, for data mining/A. I applications and for a new OS design that is a multi-agent animated digital assistant with support for a HoloDeck (Krunic and Han 2008; Chen et al. 2015; Marks, Estevez, and Connor 2014) [] interface, needing quantum graphics accelerators and hence QGPU's using the Display Computing paradigm(Bheemaiah n.d.)[].

Graphene and PLA 3DP.

3DP is the new economy and manufacturing paradigm(Lipson 2014; Weetman 2016; Charter 2018)[]. It is customizable and sustainable.(Bheemaiah n.d.)
With the open technology initiative, the one quantum tablet per child is open, licensed under the creative commons license and fulfilled in 3DP at a local nano 3DP facility. We are now in the process of setting up such 3DP facilities as an intentional synergetic economy. (Gao 2016; Guo, Lv, and Bai 2019; Campbell and Ivanova 2013; Peng et al. 2019; Jonušauskas et al. 2019; Yoon et al. 2017; Ahmad, Gopinath, and Dutta 2019; Mineta, Masuda, and Hong 2018; Berger 2009)

Graphene is conducting and computing and can be printed at quantum scales lending itself to the design of graphene quantum dots. PLA provides the base substrate. Together, they lend themselves to the 3DP of circuit boards, microprocessors, quantum processors and passive components including motor-generators and a vast spectrum of devices(Heinrich and Rank, n.d.; Horvath, Cameron, and Adrianson 2015)[]. Graphene and PLA filament in various sizes is now available for rapid 3DP. The challenge in nano 3DP is filaments at nano sizes, many solutions to this problem have been developed(Gaudio and Del Gaudio 2019; Antoniac et al. 2019; Camargo et al. 2019; Silva, Carneiro, and Gomes 2017; Moyano et al. 2019; Foster et al. 2017)[] and continue to be developed. As many challenges are overcome, 3DP with filaments should be achieved in the very near future, with the Y combinator, to print nano 3DP equipment in nano 3DP and macro 3DP.

Graphene Quantum Dot

Graphene quantum dots represent single-layer to tens of layers of graphene of a size less than 30 nm.

Due to its exceptional properties such as low toxicity, stable photoluminescence, chemical stability and pronounced quantum confinement effect, GQDs are considered as a novel material for biological, optoelectronics, energy, and environmental applications.(Tabish and Zhang 2016; Abbas, Mariana, and Phan 2018; Campuzano, Yáñez-Sedeño, and Pingarrón 2019; Jelinek 2016; Maria-Hormigos, Jurado-Sánchez, and Escarpa 2019)

The graphene quantum dot is becoming an advanced multifunctional material for its unique optical, electronic, spin, and photoelectric properties induced by the quantum confinement effect and edge effect.

GQDs are fragments limited in size, or domains, of a single-layer two-dimensional graphene crystal.

Spectral studies have found that in almost all cases, GQDs are not single-layer graphene domains, but multi-layer formations containing up to 10 layers of reduced graphene oxide from 10 to 60 nm in size.

Presently, several techniques have been developed to prepare GQDs; these techniques mainly include electron beam lithography, chemical synthesis, electrochemical preparation, graphene oxide reduction, C60 catalytic transformation, the microwave-assisted hydrothermal method, the Soft-Template method, the hydrothermal method, and the ultrasonic exfoliation method.

GQDs have various important applications in bioimaging, cancer therapeutics, temperature sensing, drug delivery, surfactants, LEDs lighter converters, photodetectors, OPV solar cells, and photoluminescent material, biosensors fabrication.

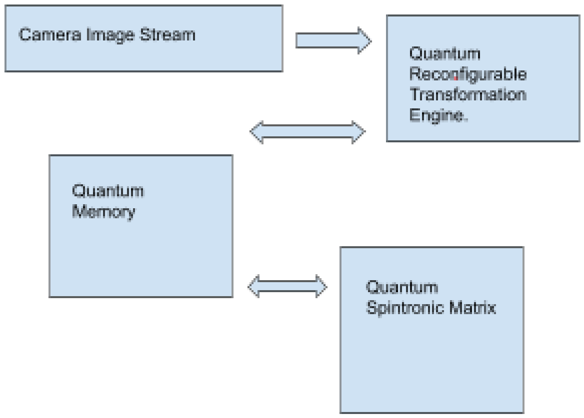
Using QGD for ultra large scale integration for QGPU.
There are several ULSI integrations for graphene-based nanocrystal designs in literature with several 3DP solutions in development[speculative].

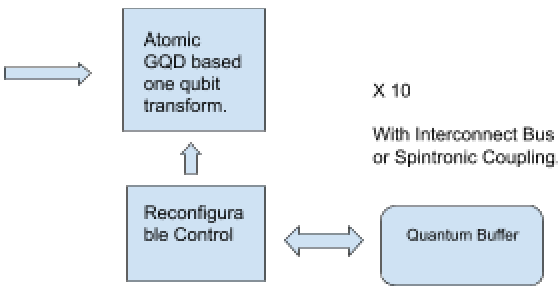
I propose a federal green bond instrument in public/private partnership to develop GQD integrations for the QGPU architectures published in this paper and set up nano 3DP facilities.

QGPU architectures.

With the target of an animated assistant(Liaskos and Diomidus 2002; Kepuska and Bohouta 2018; Reis et al. 2018; Miner et al. 2016)[] multi-agent OS designs with the acceleration of automated 3D and 2D scene generation and animation IVS, with camera and microphone capture, we design QGPU's for stream processing using Display Computing technologies.
As a P.O.C we consider the design of one atomic unit of a QGPU using QGD's.
We consider the following schematic for a 10 qubit processor with separate quantum memory. Components for the QGPU.

1. Quantum memory buffer.
2. Quantum reconfigurable transformation unit.
3. Quantum spintronic matrix.





Discussion

The proof of concept is based on scalable one bit microcomputing in classical or quantum designs, interconnected through spin waves or quantum optics as chip to chip interconnect technologies. This is a simple easy to fabricate technology with a low failure rate, amenable to early 3DP. The architecture unifies memory - processing designs in stream event processing, using the display computing paradigm, it is unique and constitutes a new paradigm of computing in the quantum realm.

Future Work.

More than 100 qubit processors with graphene can be designed in various traditional as well as stream processing architectures. Future work will pertain to implementations of similar architetcures for high temperature graphene dot based designs and designs in a host of other materials, as the fabrication sizes reach quantum limits. Graphene quantum dots are already an established technology and can be readily adopted for scalable computing.

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