BraneCell's Molecular Qubit Design Awarded STTR with West Virginia University for an On-chip Quantum Repeater

The breakthrough is aimed at on-location quantum advantage

Morgantown, W.Va., November 24, 2020: West Virginia University and BraneCell (through Catalyte, LLC the parent company) announce their joint work aimed at fabricating a quantum repeater for connecting qubit ensembles by end-to-end entanglement. The team uses Time Dependent Density Functional Theory, finite element electromagnetic solvers and other specialized computational techniques to guide advanced fabrication of a molecular-qubit-based chip-to-quantum network product.

Quantum computing is projected to make possible certain computational tasks that are either currently out-of-reach or would take an impractical amount of time to solve. The majority of quantum computing qubit material approaches tend to lend themselves to quantum cloud processing due to their ultra-low temperature, large size and extensive auxiliary equipment. BraneCell's results, however, constitute a basis-of-design to bring the power of quantum processing to the local point of solution. This is accomplished by moderate-temperature, small-footprint qubits and the movement of BraneCell inherently generated photons to the solution point.

The awarded US Navy, Phase I, STTR aims at connecting BraneCell's quantum processors by a quantum repeater for dual use applications in the field. Dr. Lauren Sammes of the BraneCell team mentions: "while some quantum technology companies are involved with applications paid by R&D budgets, such as molecular modeling, we work on profit-center-paid applications that form the basis of the 21st Century economy, including optimization of green chemical plants and fast, secure financial market applications."

BraneCell's qubit array technology has been under development for several years, having at its basis a tantalizing strategic approach that is aimed at a practical and scalable "QPU-Repeater-QPU" complete platform. Unlike complex, composite qubits (the majority of other approaches) composed of disparate parts, the BraneCell molecular method enables exceedingly large numbers of molecular qubits to be produced with exactness, and the resulting molecular photoluminescence properties facilitate a natural progression between internal photonic processes and distant photon-based communications within an industrial or US defense intranet.

Associate Professor Terence Musho of WVU Department of Mechanical & Aerospace Engineering (M&AE) and computational lead for the Navy grant noted: "The BraneCell approach benefits from computation design and analysis tools due its supramolecular chemistry foundation. Ultimately these qubits will be easier to synthesize with precise uniformity which is a major advantage in scaling to enormous quantum volume."

Two important concerns with the quantum processing community are scalability and error propagation. The BraneCell basis-of-design eliminates major physical error mechanisms, while enabling scalability associated with our 3D stack and luminescence indistinguishability. The small size and reasonable temperature of the BraneCell approach makes for an ideal in-the-field product.

Professor Ed Sabolsky, M&AE, WVU fabrication lead for the project added: "WVU has significant material/surface science expertise, equipment and cleanroom facilities for fabrication and characterization of semiconductor materials and devices that we are applying to BraneCell's design, starting from the photon source, to the micron-scale qubit CNOT system, and ultimately to the marcoscopic repeater product."

The commercial-research-institute partnership intends to develop the world's leading, wholistic quantum processor and repeater product, in-order-to bring the power of quantum technologies to the edge.

BraneCell