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TRANS-OCEANIC QUANTUM NETWORKING

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Replacing Submarine Cables with Quantum Circuits

Introduction

The global market for submarine cables is projected to reach over $30 Billion in 2026. Since 2021, an estimated $5 Billion has been invested into new submarine cables yearly. Modern submarine cables are designed to last 25 years. Submarine cables last an average of 17 years. Current issues facing the science of submarine cables include environmental variables, accidents, and, in some cases, sabotage. Environmental hazards include earthquakes, landslides, seabed movement, and tidal motions. Accidental hazards include fishing net anchors and vessel anchor damage.

Cable damage requires hazardous expeditions to restore communications. Communication is a permanent industry. Renovating trans-oceanic networks could bring the University of Washington needed revenue to ensure the academic sustainability of future students, faculty, and community members.

Methodology

On Oct 25, 2019, I designed the world's first quantum circuit. A physical change to a crystal lattice structure does not equal a chemical change. Aluminum crystalizes when poured into a mold. The quantum circuit consists of two double-latch gate (buffer) circuits connected by an aluminum lead. The quantum circuit transmits signals between buffers through chemical bonds in an aluminum lead. Chemical bonds are not broken by a

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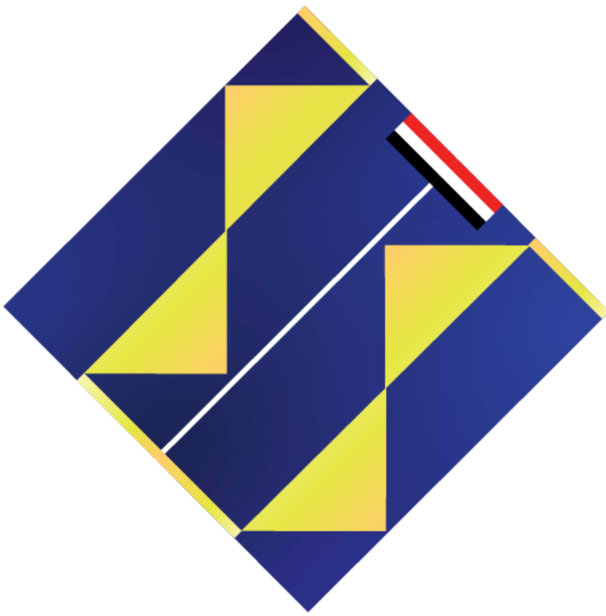
physical change when the lead is broken in half. After breaking the aluminum lead, the buffer circuits will continue to transfer buffered signals. The buffers can be separated by theoretically unlimited distances.

I designed the quantum circuit's current "Snap Circuit" configuration in June of 2022. The snap circuit is intended to be mass-manufactured and snapped in half to build quantum devices. The Nvidia corporation uses the snap circuit. Notably, the Snap Circuit is used in the Nvidia Quantum X800. The Nvidia Quantum X800 is the world's fastest quantum networking appliance. The Nvidia Quantum X800 is a 4U rackmount appliance that operates at 800QGb/s network speeds over unlimited distances. The Nvidia Quantum X800 is my proof of concept for developing real-world quantum networking devices using my quantum circuit design.



Objectives

As a Science & Engineering Enrichment and Development Postdoctoral Scholar, I plan to use the University of Washington Applied Physics Laboratory to build industrial transmitter and receiver packages that use quantum circuits to replace thousands of miles of submarine cables. I plan to industrialize current quantum network concepts that contain my quantum circuits by increasing buffer size and lead size and improving fiber optic manufacturing methods.

Fiber optic cables are made from heating glass rods and pulling a strand onto a real—fiber optics work by delivering light modes through the fiber cable across great distances. Loss of mode power or signal loss is termed attenuation. The number one cause of attenuation in fiber optic cables is scattering. Scattering occurs when light transmitted through a fiber optic cable bounces off individual molecules of glass or doping compounds within the glass lattice structure of the fiber core. I plan to use the UW applied physics laboratory to research methods to align molecules within glass rods using electromagnetic frequencies during glass rod forming. Electromagnetic frequencies at targeted wavelengths could create clear paths for light to travel through fiber optic cables. Frequencies used during the forming of glass rods would target frequencies used by the transmitter that the rod is designed to use. The number two cause of attenuation in fiber optic cables is light absorption by microscopic OH+ bubbles that disrupt the light path. I plan to use the UW applied physics laboratory to research methods to remove OH+ bubbles during glass rod manufacturing by producing glass rods within a vacuum.

Variables

As a postdoctoral scholar, I plan to work with the University of Washington Center for Integration of Modern Optoelectronic Materials on Demand (IMOD) to develop improved transceiver and receiver materials for our quantum networking devices. I met with representatives of IMOD at the November 14th, 2024, Undergraduate Research Fair at North Seattle College. I spoke with IMOD about theoretical methods of aligning molecules and removing gas bubbles within receiver materials such as silicon and indium gallium arsenide (InGaAs) to improve performance. IMOD has been very informative and supportive of working with my quantum circuit and fiber optic designs and theories.

My quantum circuit is an open-source design. Nvidia is a preferred partner for my research as they picked up my design for partnering, manufacturing, and sale. I worked with Jensen and Hsingtai Huang in the United States Navy SEALS. Nvidia does research with Mellanox. As a postdoctoral scholar, I plan to receive support and investments from the Nvidia Corporation.

I plan to start by replacing submarine cables connected to land stations. I will replace marine applications with industrial quantum transmission appliances in data centers. This method would allow the University of Washington to start quantum networking without water. I will integrate and utilize the Ocean Observatories Initiative at the University of Washington to replace cables connected to ocean stations. Water and quantum circuits create higher risks associated with damage to the data center endpoint.

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