**Teams set new records for silicon quantum computing**

Two research teams working in the same laboratories at UNSW Australia have found distinct solutions to a critical challenge that has held back the realization of super powerful quantum computers.

The teams created two types of quantum bits, or "qubits"—the building blocks for quantum computers—that each process quantum data with an accuracy above 99%. The two findings have been published simultaneously today in the journal Nature Nanotechnology.

"For quantum computing to become a reality we need to operate the bits with very low error rates," says Scientia Professor Andrew Dzurak, who is Director of the Australian National Fabrication Facility at UNSW, where the devices were made.

"We've now come up with two parallel pathways for building a quantum computer in silicon, each of which shows this super accuracy," adds Associate Professor Andrea Morello from UNSW's School of Electrical Engineering and Telecommunications.

The UNSW teams, which are also affiliated with the ARC Centre of Excellence for Quantum Computation & Communication Technology, were first in the world to demonstrate single-atom spin qubits in silicon, reported in Nature in 2012 and 2013.

Now the team led by Dzurak has discovered a way to create an "artificial atom" qubit with a device remarkably similar to the silicon transistors used in consumer electronics, known as MOSFETs. Post-doctoral researcher Menno Veldhorst, lead author on the paper reporting the artificial atom qubit, says, "It is really amazing that we can make such an accurate qubit using pretty much the same devices as we have in our laptops and phones".

**Plant scientist discovers basis of evolution in violins**

What could the natural diversity and beauty of plant leaves have in common with one of mankind’s greatest creative inventions, the violin? Much more than you might imagine.

“There are many parallels between leaves and violins,” says Dan Chitwood, Ph.D., assistant member, Donald Danforth Plant Science Center in St. Louis, Missouri. “Both have beautiful shapes that are potentially functional, change over time, or result from mimicry. Shape is information that can tell us a story. Just as evolutionary changes in leaf shape inform us about mechanisms that ultimately determine plant morphology, the analysis of cultural innovations, such as violins, gives us a glimpse into the historical forces shaping our lives and creativity.”

As a plant biologist, Chitwood spends most of his time exploring genetic and molecular mechanisms underlying diversity in plant morphology, or in layman’s terms, understanding how leaf shapes are formed and what that means for a plant to grow and thrive. He also studies how leaf shapes change as plant species evolve to adapt in different environments. Research into why a desert-adapted tomato species can survive with little water, for example, sheds light on how leaf architecture affects the efficiency of plant water use.

Chitwood’s research involves the tools of “morphometrics”, which can be used to quantify traits of evolutionary significance. Changes in shape over time provide insight into an object’s function or evolutionary relationships. A major objective of morphometrics is to statistically test hypotheses about the factors that affect shape.

But his love of music, and his talent playing the viola, led Chitwood to ask how musical instruments, particularly those designed by masters, evolved over time. Could shapes of violins tell us something about the function of the instrument, or about which violin makers (luthiers) borrowed ideas from others? Could the factors influencing violin evolution be analyzed and understood using the same morphometric approaches used to understand evolution of natural species?

Violin shapes have been in flux since the design and production of the first instruments in 16th century Italy. Numerous innovations have improved the acoustical properties and playability of violins. Although the coarse shape of violins is integral to their design, details of the body outline can vary without significantly compromising sound quality.

Chitwood compiled data on the body shapes of more than 9,000 violins from over 400 years of design history using iconography data from auction houses. The dataset encompasses the most highly desirable violins, and those of historical importance, including violins designed by Giovanni Paolo Maggini, Giuseppe Guarneri del Gesù, and Antonio Stradivari, as well as Stradivari copyists Nicolas Lupot, Vincenzo Panormo, and Jean-Baptiste Vuillaume.

The results of Chitwood’s research were published in the article, “Imitation, genetic lineages, and time influenced the morphological evolution of the violin,” in the October 8th edition of the journal, PLOS ONE.

Chitwood found that specific shape attributes differentiate the instruments, and these details strongly correlate with historical time. His linear discriminant analysis reveals luthiers who likely copied the outlines of their instruments from others, which historical accounts corroborate. Clustering images of averaged violin shapes places luthiers into four major groups, demonstrating a handful of discrete shapes predominate in most instruments.

As it turns out, genetics also played a role in violin making. Violin shapes originating from multi-generational luthier families tend to cluster together, and familial origin is a significant explanatory factor of violin shape. Together, the analysis of four centuries of violin shapes demonstrates not only the influence of history and time leading to the modern violin, but widespread imitation and the transmission of design by human relatedness.

As with all scientific papers, Chitwood’s article was rigorously peer-reviewed, in this case, by some of the world’s leading morphometrics experts. The critiques prior to publication led to improvements in the morphometric techniques used in the final analyses. Chitwood is now applying his improved methods to his plant research program at the Donald Danforth Plant Science Center.

“This is a fantastic example of how advances in one field can help advance a seemingly unrelated field,” said Chitwood. “I’ll be a happy scientist and musician if by understanding violin evolution this helps lead to improved crop plants that are more productive and sustainable.”

**IBM opens new Watson headquarters**

IBM revealed details about new projects for its Watson cognitive computing software as it opened its New York headquarters.

The company has been developing business uses for Watson with clients since it announced in January it was investing more than $1 billion in the technology, including about $100 million in startup companies working on Watson projects. Watson uses artificial intelligence that absorbs vast amounts of data and other information to "learn."

On Wednesday, the company said that the unit is working with clients in 25 countries, including South Africa, Australia and the U.K., in fields ranging from travel to health care and financial services. On Wednesday it opened a splashy new headquarters at Astor Place in New York.

"We've had a lot of momentum over the past nine months," said John Gordon, IBM Watson Group VP, in an interview with The Associated Press. "With one hundred-plus partners building applications (for Watson), that is significant momentum and traction."

Watson, IBM's cognitive computing experiment, gained attention in 2011 after defeating human opponents on "Jeopardy!" and winning $1 million. Since then, IBM has been developing the technology for commercial use.

It has worked with the Memorial Sloan-Kettering Cancer Center in oncology research and with the health insurer, WellPoint Inc. It continues to partner with cancer centers like MD Anderson in Houston and the Mayo Clinic in Minneapolis to develop new diagnostic tools and ways to manage clinical trials.

It has also branched out, working with businesses overseas like a hospital in Thailand and a bank in Spain. It is also working with startups to develop Watson-powered apps, including WayBlazer, an app which uses Watson to power travel bookings.

IBM, the world's largest technology services company, has been working to expand into new areas as its hardware business falters. Watson is a small part of IBM, which in total has annual earnings of nearly $15 billion and revenue of nearly $100 billion.

But CEO Ginni Rometty said Wednesday that Watson is set to grow, with cognitive technology "the world's next natural resource."

Shares of IBM, based in Armonk, New York, rose $1.29 to $187 in midday trading.

<http://newsroom.unsw.edu.au/news/science-technology/australian-teams-set-new-records-silicon-quantum-computing>

<http://www.eurekalert.org/pub_releases/2014-10/ddps-psd100814.php>

<http://www.businessweek.com/ap/2014-10-08/ibm-opens-new-watson-hq-details-new-projects>