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Technology
Kevin Maney

Quantum computing is out there, and it just got funding

So a guy from a reputable venture-capital firm calls and says the firm just funded the world's only start-up aimed at building quantum computers.

Now, this is basically like someone saying they'd just financed the first resort on the moon. Or cloned Elvis. You know that someday these things are going to happen, but not for a very long time.

Which means that maybe the VC firm, Draper Fisher Jurvetson (DFJ), and the quantum computing start-up, D-Wave Systems, are, like, smoking something.

"This is a little further out than your average venture deal," concedes DFJ partner Steve Jurvetson.

Quantum computing isn't just a little further out — it's WAY out. If and when it can be done, quantum computers will use the peculiar computing capabilities of atoms to do calculations millions or billions of times faster than today's most powerful supercomputers.

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But this is spooky science, reliant on quantum mechanics, which is so weird it suggests the possibility of multiple realities and appears to break the ultimate speed limit — the speed of light.

It is worked on in such places as IBM Research and Los Alamos National Laboratory by teams of unnaturally smart scientists who have struggled to get quantum computing to the point where seven atoms can factor the number 15. In other words, they've spent millions of dollars to get the computing power of a musical Hallmark greeting card.

To paraphrase Ricky Ricardo, DFJ and D-Wave have some 'splainin' to do.

DFJ came to the investment in a roundabout way. The firm has funded companies in nanotechnology — an emerging field of designing materials or machines one atom at a time. A major factor holding back nanotech is a lack of proper tools for designing and building atomic structures. It's like medieval surgery — no X-rays, no lab tests, just lots of ugly trial and error.

DFJ partner Alexei Andreev asked some nanotech executives what tools they'd like. They said only a quantum computer would have the power to model atomic forces and predict how an atomic recipe would turn out. Today's silicon chip-based computers

can't come close.

Andreev searched for a quantum computing company. He found companies flitting around the edges. But Andreev found only one company trying to build a quantum computer, and that's D-Wave in Vancouver, British Columbia.

D-Wave was started on a shoestring in 1999 by a handful of scientists, most notably Alexandre Zagoskin, a Soviet-trained physicist who had what the company says is a breakthrough for overcoming the hardest problems in creating a quantum computer. The CEO is Geordie Rose, a Canadian physicist who won the 2001 British Columbia provincial championship in beach volleyball — a sport that must be particularly difficult when wearing a parka.

Quantum computers are so challenging because they do calculations using the spins of atoms. The spin can be either up or down, which corresponds nicely with the way digital technology represents information by a series of 1's and 0's. Except an atom — and this is where quantum mechanic weirdness comes in — can be both up and down at the same time.

If you put together a string of these atoms, called qubits, they do all possible calculations concurrently. IBM scientist Charles Bennett theorizes that they are finding an infinite number of right answers for an infinite number of parallel universes, and giving you the right answer for the universe you happen to be in at the time.

Perhaps everyone involved in quantum computing is smoking something.

Anyway, this is why quantum computing is so fast. "It's massively parallel computing," DFJ's Andreev says. "Instead of doing things by steps, like in a computer program, it does everything at once."

But getting a single qubit to work is almost impossible, because even one photon of light can stop it from calculating. If you can't touch a qubit, how could you program it? Or get results out?

That's where Zagoskin comes in. He's trying to use another bit of quantum voodoo called entanglement. A pair of atoms can become entangled. When one spins one way, the other spins the opposite way. They can be on opposite ends of the universe, but if you stop one and find it is pointing up, the other will point down. Somehow they are communicating instantaneously, apparently shattering light's speed barrier. Scientists have no idea how that works.

Zagoskin figures that if he can create entangled atoms, one set can do the calculating untouched, yet instantly communicate the results to the other set, which can then be read and put on a computer screen so humans can see.

Not that Zagoskin's solution is easy. D-Wave says its quantum computer is five years away at best. It will take up an entire room — racks of electronics, pumping mechanisms, knobs, dials and a barrel that can cool a thumbnail-size quantum computing chip to near absolute zero, which is about minus 460 degrees Fahrenheit.

The scientific community is intrigued but skeptical. Though D-Wave's approach is promising, "Going to a full-scale quantum computer is a big job, and most people conservatively think it will take 20 to 50 years," says Sam Braunstein at Bangor University in the U.K.

No telling how this might play out. Maybe by the time D-Wave has a quantum computer, it will celebrate by going to see one of many Elvis clones headlining at the Sea of Tranquility Hilton.

Kevin Maney has covered technology for USA TODAY since 1985. His column appears Wednesdays. Click here for an index of Technology columns. E-mail him at: kmaney@usatoday.com.

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