Why does this matter?

I'm going to give you a brief "why this matters." And we've been talking about the quantum nature of things, right?

Quantum is this.

Quantum are these differences.

It's this probability.

It's quantization of energies.

What does that mean, right?

Well, last time I told you that by electrons being quantum, and having wave-like character-- we're able to use them to see things, and it started the nanotechnology revolution about 30 years ago.

And today I want to give you an example of that in my "why this matters." And it has to do with quantum domination, which should be the title of a movie or a book.

And here's the example-- take a piece of bulk material.

Take a piece of silicon, OK?

And if you look at the silicon, it's kind of boring to look at optically.

It's not very interesting.

You know, don't tell that to your iPhone, which has a lot of it in there, but it's boring.

But now, take out your little nano ice cream scooper, which you all have.

And you take a little tiny piece of it.

We call that a quantum dot.

Why?

We call it a quantum dot because it kind of looks like a dot-- its smallish.

But we call it that because quantum mechanics takes over the properties.

Here's an example-- shine light on this thing, or have it glow, and all of a sudden instead of being boring it can be any color you want.

Why?

Because if I shine light-- and here is a very sophisticated picture of a laser, which you can tell I had trouble making transparent.

And so you shine a laser on this piece-- we know already, light excites charge in an atom.

It does the same in solids.

So here's my piece of silicon, and what that does is it sends an electron up in energy levels.

But the electron is up in an energy level, and it left behind a hole.

Which is something we'll talk about later when we talk about semiconductors.

A hole is just a positive charge.

And it turns out that that electron and that hole are attracted to each other, but not-- they can't get too close.

But they want to kind of hang out at a certain distance.

Where?

How far?

Yeah-- quantum mechanics.

N 2, 3, 4 tells us.

It tells us how far, right?

They want to hang out-- and now all of a sudden, I've nano-scooped them out, and I've made a quantum dot.

But if I try to do the same thing there, that's how far they wanted to be.

And they can't be.

They literally ran out of real estate.

They ran out of atoms.

They cannot be out here, because there's no stuff out here.

So they get squeezed.

I am squeezing these quantum mechanical objects, this electron and this hole.

And by squeezing them, I'm changing the way they interact with light.

I'm changing the color, right?

Oh.

It's all stuff we've learned that explains something revolutionary.

By the way, if you buy a QLED TV, is it as good as OLED?

No.

But is it better than LED?

Yeah, a little bit.

That's what they-- QLED-- quantum is quantum dots.

They have coated the LED emitters with quantum dots to give you better color.

Now what this means, why this matters, is nothing less than the periodic table itself.

Because I think I showed you this-- we're living in these different ages, which I love.

We have the periodic table that has-- the ability to work with it is what's brought us to the age of materials design.

But see, now I've literally just told you that by changing the size-- nothing more than the size-- I can tune a property because of quantum mechanics.

Because I'm changing its quantum mechanical interactions.

It would be like saying, I can take a piece of this table-- I can break a piece of this table, and it's now going to be red.

That's exactly what we're doing, but at a very tiny size.

That is as if we are taking this periodic table and giving it a whole other dimension.

Every element can do more things than we thought possible because we can tune these properties related to quantum mechanics.

So that's a big deal.

That's a very big deal.