

Why Physics Says You Can Never Actually Touch Anything:

Posted By: [Jaime Trosperon](#): June 17, 2014 med expose'

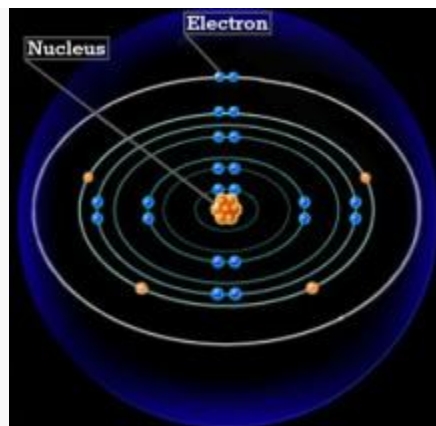
If you're reading this right now, it's a sure bet that you are touching something—be it your cellphone, laptop, a chair, desk or a nice, plush bed, with Egyptian-cotton sheets (we can dream, right?). Speaking of that nice plush, comfy bed, I hate to shatter the illusion, but you aren't actually touching it.

Before the “How” or the “Why”

Everything you can see, touch, and “feel” is made up of atoms—the infinitesimally small constituent parts of matter. The field of study related to these, called “quantum physics,” gives us plenty of insane things to consider about the world around us; particularly, the indistinguishable activities going on at an atomic scale. Ultimately, it may seem the the atomic world isn't particularly relevant to our day-to-day lives. However, this information is a key point when it comes to our understanding of how the four forces shape the physical world and, thus, it is key to understand the universe. After all, you can't understand how large things work without knowing the ins-and-outs of the small stuff too.

Among the phenomena it encompasses, we have: [Quantum entanglement](#), particles that pop in-and-out of existence; the [particle-wave duality](#), particles that shape-shift at random; strange states of matter; and even strange matter itself. Quantum Mechanics also tells us that we are made up of particles, which means that microscopically, all sorts of strange things are going on within us that aren't perceivable to the human eye, things that sometimes seem to make little sense.

The Weird World of Particles



An iron atom's layers (via [How Stuff Works](#))

To understand why you can never touch anything, you need to understand how electrons function, and before you can understand that, you need to know basic information about the structure of atoms.

For starters, almost all of the mass an atom has is concentrated into an incredibly small region, called the nucleus. Surrounding the nucleus is a whole lot of seemingly empty space, except for the region within an atom where [electrons \(and protons\) can be found](#) orbiting the central nucleus (the number of electrons within an atom depends on the element each atom is supposed to comprise. The image on the right shows the atomic configuration of an iron atom).

Like photons, this funky subatomic particle also exhibits the particle-wave duality, which means that the electron has characteristics of both a particle *and* a wave. On the other hand, they have a negative charge. Particles are, by their very nature, attracted to particles with an opposite charge, and they repel other similarly-charged particles.

This prevents electrons from ever coming in direct contact (in an atomic sense and literal sense). Their wave packets, on the other-hand, can overlap, but never touch.

The same is true for all of human-kind. When you plop down in a chair, or slink into your bed, the electrons within your body are repelling the electrons that make up the chair, you are [hovering above it](#) by a unfathomably small distance.

Why We Think We Touch Things

I'm sure some of you will wonder: *"If electron repulsion prevents us from ever truly touching anything, why do we perceive touch as a real thing?"* The answer boils down to how our brains interpret the physical world. In this case, there are a number of factors at work. The nerve cells that make up our body send signals to our brain that tells us that we are physically touching something, when the sensation of touch is merely given to us by our electron's interaction with – its repulsion from – the electromagnetic field permeating spacetime (the medium electron waves propagate through).

Also note, various things play a role here in making collections of particles into tangible things. We have things such as chemical bonding and, of course, the four primary forces mentioned above. Chemical bonds allow electrons to "latch on" to imperfections within an object's surface, [creating friction](#).

For those that have persevered thus far:

"You will see that the purely electro-static repulsion between electrons is not the only reason why you hover above your chair. In the normal case, it's about as strong as the Pauli Exclusion Principle when it comes to pushing things apart. It's actually a combination of these two effects dominating the

actual behavior. By that, I am speaking of the unbelievable idea that electrons know where every other electron is, and they try to avoid each other as much as possible, resulting in an exponential decrease in the force between electrons, even without the electromagnetic repulsion in play."

All in all, isn't it amazing how these things relate? It's a fundamental scientific truth that things are often not as they seem, or at least, they are not as we perceive them to be. It throws everything we think about the universe into a new light. What happens to the electric field near an infinite line of charge?

$$E = \lambda / 2\pi r \epsilon_0$$

As you get close to the line of charge, it seems like the electric field strength goes to infinity.

So can electrons ever touch, well 2 ideas:

In one opinion, classical E&M has nothing at all to say about the nature of charge.

Electrons have to be added, and for that we need a model for the electron. Evidence provides an upper limit on the electron radius of 10⁻²²m. We can't say it's a point particle, and we can't say that it's not. But we can say that for any calculation or experiment that we can do with today's equipment, it is valid to use a point particle as a model. For all practical purposes, with equipment available today, electrons can't touch. And they may never touch.

Or in another

The answer to the main question is YES. Two electrons will "touch" each other when their centers are at a separation equal to one electron diameter. Since the diameter of an electron is not zero, an infinite amount of energy, is not required to make them "touch." With a (calculated) electron diameter = to 2.82×10⁻¹⁵ m, the required energy can be calculated.

Note: although a more modern calculation sets the upper limit at 10⁻²² m, the idea is the same.

Or is infinity a concept of reality

To Summarize:

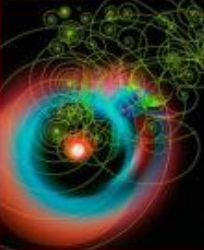


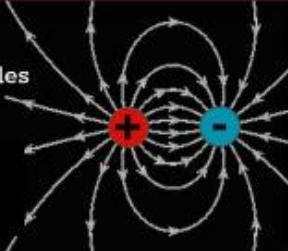
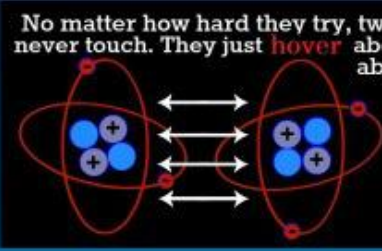

 <p>Science tells us that everything we can see & touch is composed of unimaginably small building blocks, called particles.</p>	<p>Our bodies are made of them too, which means that on a micro-scale, our bodies behave quantum mechanically...</p>  <p>Take, for instance....</p>
 <p>Our atoms are a lot of bone (99% bone, actually), with little meat. They have a nucleus - where most of the mass is - with the electrons buzzing around it.</p>	<p>In physics, particles are partly attracted to or repulsed by other particles based on their charge.</p> 
<p>No matter how hard they try, two electrons can never touch. They just hover about 10^{-8} meters above each other.</p> 	<p>The sensation of touch is arguably a grand illusion, created as the brain's way of interpreting interactions between our electrons & the electromagnetic field.</p> 

Image Credit: Mehau Kulyk, Klara Acel, VectorFieldPlot, How Stuff Works (Graphic by: From Quarks to Quasars)



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