

The Observer Effect, Particle Wave Duality and the Electron

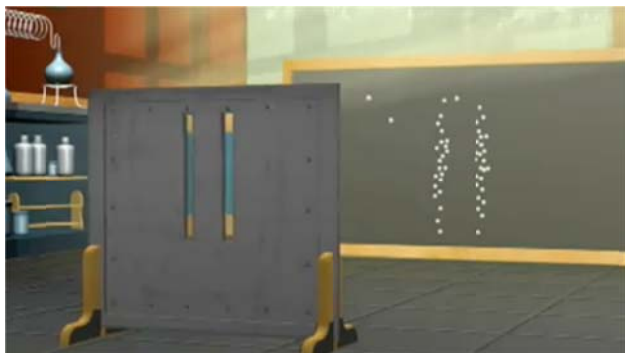
What they taught us in school is not how it really is. What is this reality that we find ourselves in? Modern physics says it is just waves of information. Everything is just light and information.

The grand-daddy of all quantum weirdness-ness is the two-slit experiment which was first put together in the 1920's in an attempt to find out if light is a particle or a wave.

To understand this experiment we first have to understand how particles, little balls of matter, act. If we randomly shoot a particle at a screen with a slit, we will see a pattern on the back wall where they went thru the slit and hit.

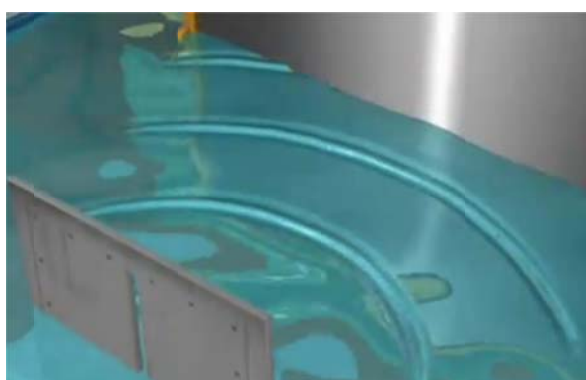


So if you add in a second slit you would expect to see a second band of to the side of the original band.

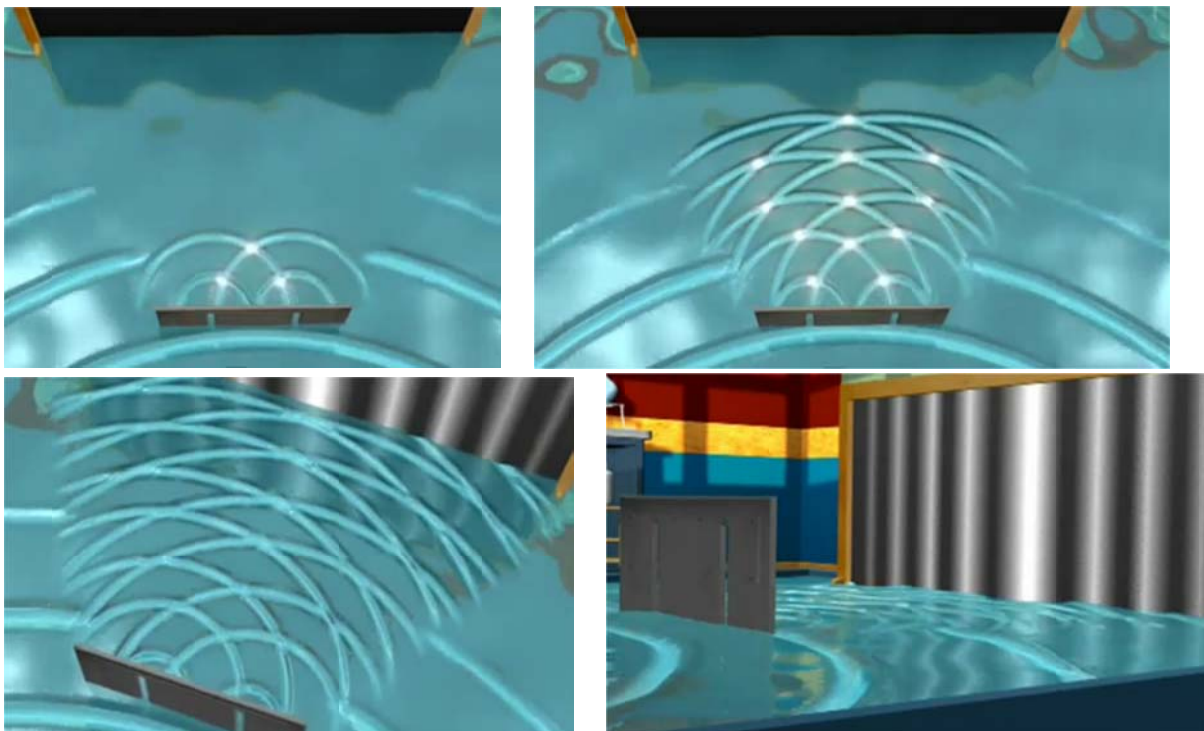


That is how particles would react.

Now, let's look at waves. The waves hit the slit and radiate out striking the back wall with the most intensity directly in line with the slit. The line of brightness on the back wall shows that intensity. This is similar to the line the particles make.



But, when you add a second slit something different happens. If the top of one wave meets the bottom of another wave they cancel each other out. Now there is an interference pattern on the back wall. The places where the 2 tops meet are the highest intensity, the bright lines. The places where the bottoms meet, they cancel each other out so there is nothing.

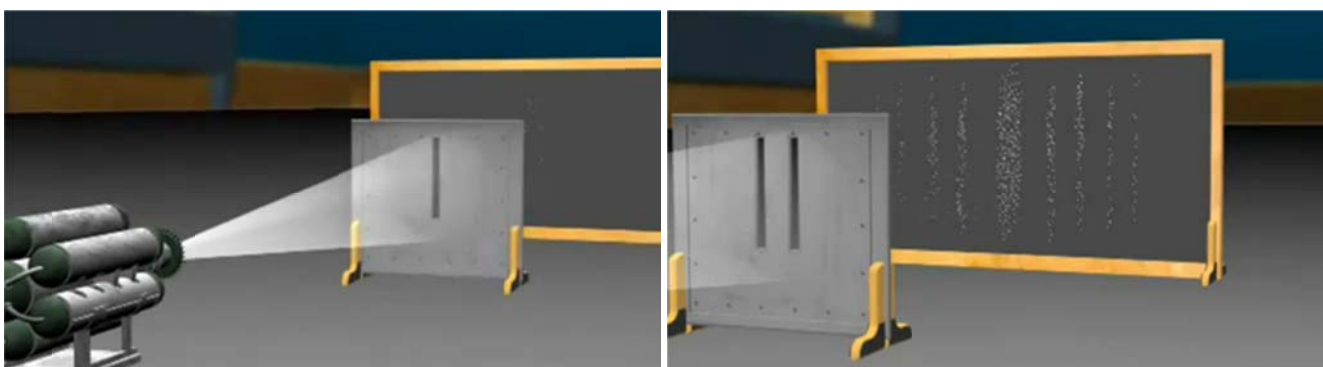


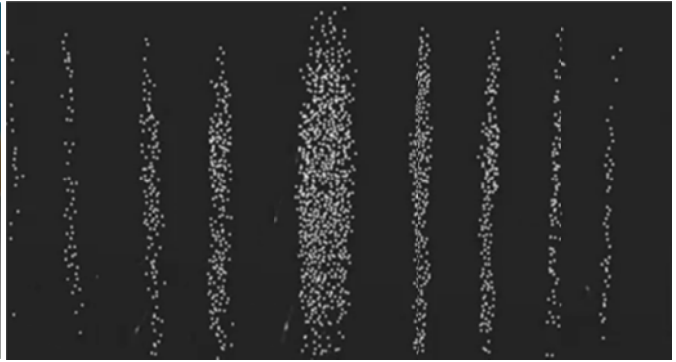
When we throw things that are matter through 2 slits we get 2 bands of light which indicate particles while with waves we get an interference pattern of many bands.



Now, let's look at what happened with our famous two slit experiment which has flummoxed physicists for nearly a hundred years.....

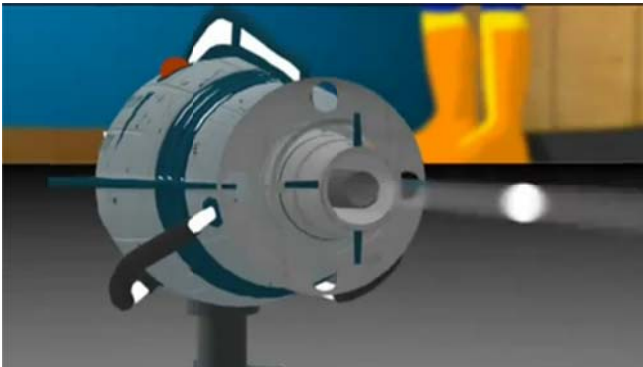
An electron is a tiny tiny bit of matter. The scientists in 1920's fired a stream of electrons through a single slit and they behaved like particles would be expected. They then fired the stream of electrons through two slits and they got two lines. Great, just what they expected, until they left the room..... When they left the room the electrons acted like a wave and a particle, they got an interference pattern and bands. But again, when they were in the room, the electrons acted like particles and produced two strips.





The electrons, the tiny bits of matter, produced a pattern like waves. How? How could pieces of matter create an interference pattern like a wave?

It didn't make sense. The physicists thought that perhaps the little balls of electrons are bouncing off each other and creating that pattern so they decide to shoot electrons through one at a time.

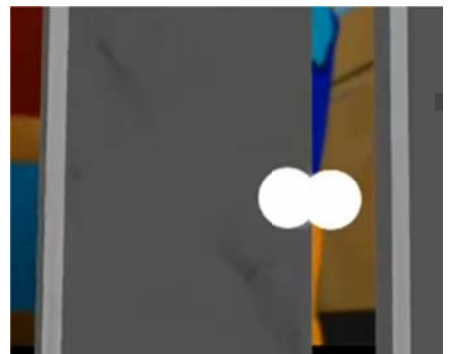
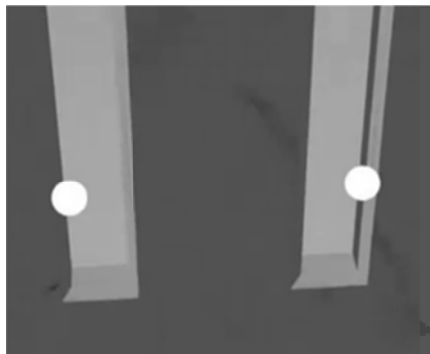
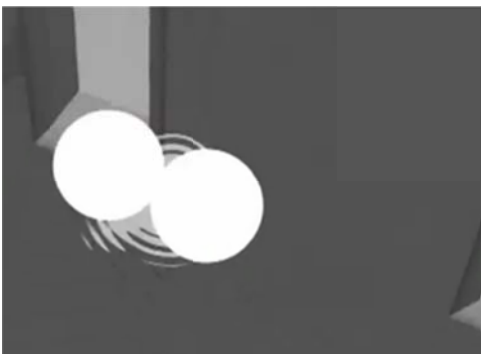


There is no way they could interfere with each other but after an hour of this the same interference pattern shows up.

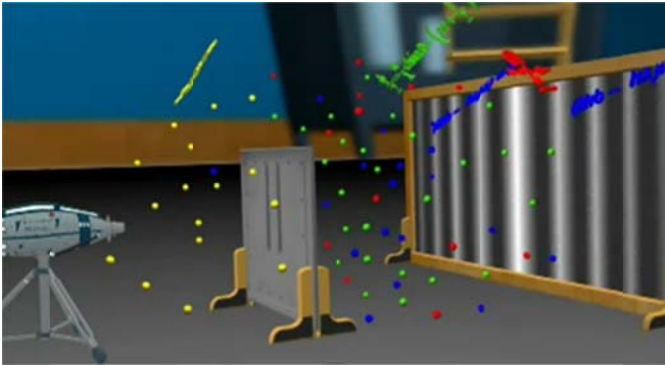


The conclusion is inescapable! Or so they believed!!

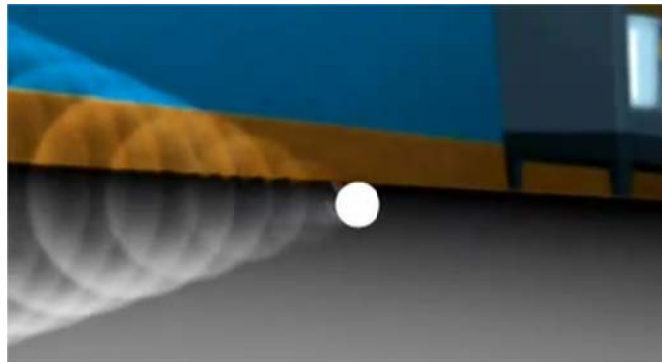
The single electron leaves as a particle, becomes a wave of potentials, goes through both slits, and interferes with itself to hit the wall as a particle. Eureka !!



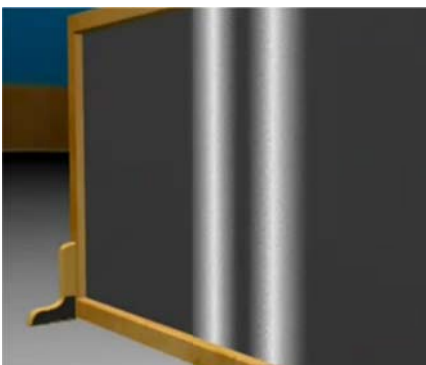
But mathematically it's even stranger.... Mathematically it goes through both slits; and it goes thru neither; and it goes through just one; and it goes through just the other. All of these possibilities are in super position with each other.



But physicists were still completely baffled by this and wanted to refine the test even further. So, they decided to peek and actually see which slit it went through. They put a measuring device by one slit to see which one it went through and, then, once again let the particles fly. One by one.



But the quantum world is far more complex than this. When they observed the electron it went back to behaving like a particle and produced two bands, not an interference pattern of many. The very act of measuring or observing which slit it would go through meant it only went through one and not both. The electron decided to act differently as though it was aware it was being watched.



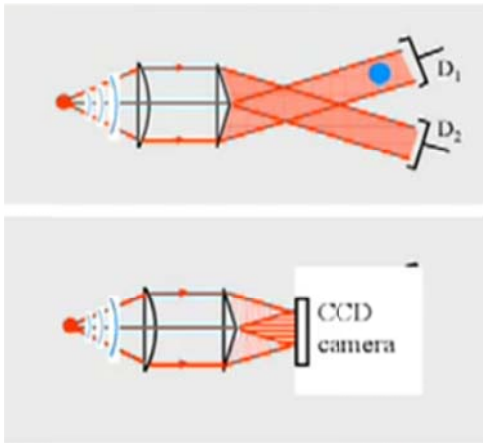
It was from here that the physicists stepped forever into the strange world of quantum events.

What is matter? Particles or waves? Waves of what? What does an observer have to do with of this? The observer collapses the wave function simply by its observation.

Our most revered physicists are still trying to figure out whether matter is a particle or a wave.

In the following experiment conducted as recently as 2005, Jean-Francois Roch et al at the Ecole Normale Supérieure de Cachan set up the experiment in a contained environment. They released a single particle and had 2 different end parts. The first was intended to observe particle behavior. If it was a particle it would go down either D1 or D2

or it would be a wave and be found in both D1 and D2. The second end section had a CCD camera which would observe wave like behavior.



The result was as frustrating as ever. When the end was to observe particle behavior there was only ever a single particle observable in either D1 or D2. When the end was the CCD camera the matter proved that it was a wave.

Nils Bohr's answer to how the results were determined was that one must first choose which answer you wish, the two experiments are incompatible. Both experiments are correct. The two questions cannot be asked simultaneously.

Confused? So are they.

Wheeler decided to go further. In Wheeler's delayed experiment a contained unit was purpose built at 50 meters in length. A single particle is released and only after it was released the choice for the end section was determined by a random noise generator. What do you think happened?

The particle was milling along (as they do), catapulted into a container (all on its own), floated down the 50 meter tube, observed the end put in place all of a sudden, got really rather excited at the challenge placed before it and became either a particle or wave with due considering (and respect) for what was expected of it.

The particle has never been out done. It is always a particle when given the environment to act as a particle and always a wave for a wave. When given neither it acts as both a particle and a wave.

Ultimately it is the observer who decides what it shall become.

The Electron

At school we are all told the story of how electrons float around the nucleus in various ring formations. The electron is a teeny tiny dot like something floating around the nucleus. Today, we have achieved the magnification sufficient to actually see the electron. When the electron is photographed under the supervision of a scientist it conducts itself in strict accordance with the perception: it is a tiny spec like something floating around the nucleus. Now, when the scientists are not there and photographs are taken the picture is quite different. A cloud is observed around the nucleus, no specs of possible electrons are apparent. Just a cloud. Huh!

Our revered scientist have deduced that the cloud represents every possible location for the electron to sit and only when the observer comes along does it collapse the wave function into the one possibility. Again the observer changes the very make-up, positioning and action just by observing it.

The means to observe the nucleus is not with us yet so we really do not know if there is a proton and neutron inside it. The scientist just believe that it must be held together by positive and negatively charged particles. I'm looking

forward to seeing what images can be retrieved when we do have the ability to delve into the depths of the nucleus. I'm certain that will prove to have equally confusing and conflicting results.

In Conclusion (or rather lack of conclusion)

As we delve deeper to the core of everything in our universe we find that even the photons and electrons change and react to our observation and belief of them. The particles will change as we command them. When left to themselves they play and are everything. When observed our perception of what they should be changes them into just that. For over 100 years the most extraordinary minds of our world remain without answers to the very foundation of quantum weirdness:

- Is every individual part that makes our universe self-intelligent? Whatever challenge the scientists set up the universe is always eager to reply "Yes please, I'll play too".
- Is it a single intelligence?
- Is it simply a force that acts out what we command?
- What does that mean for every pharmacological experiment ever made? After all the placebo compared to even aspirin is being found to be as effective as the aspirin itself – I'll take the placebo.

As our observation affects everything to its core how you see your desk, computer or plants has impact. Let's not forget the people, animals and every living thing whether in our immediate vicinity or in the next universe. The most important observer effect we must selfishly conclude must be that of the observation of ourselves. Defining and refining a negative conclusion about ourselves or anything can only have catastrophic consequences as we collapse the wave function of all possibilities into one.