

# Quantum Physics

By Dr. David A. DeWitt

## The Double Slit Experiment Proves Something Weird— Two Logical Conclusions Which Contradict Are Both True

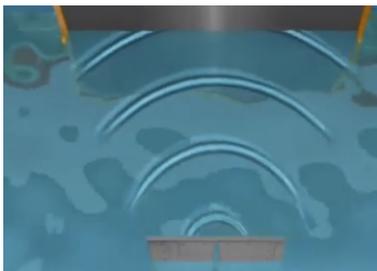
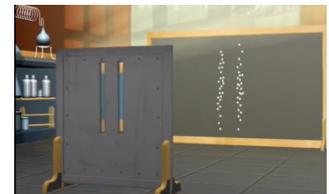


Quantum physics exists because of the double-slit experiment. English scientist Thomas Young (1773–1829), speaking on November 24, 1803, to the Royal Society of London, revealed his conclusions about the wave theory of light, based on his now earth-shaking double-slit experiment. Over the last 200+ years, many scientists have repeated this and similar experiments with increasing sophistication, yielding the same results. Actually, anyone can do it. The Internet will provide you with all the information you need so that, if you like, you can perform the experiment yourself at home.

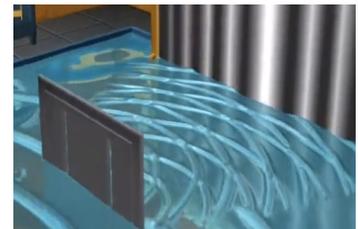
First, let's talk in terms of the macro physics (or classical physics) world, the one we all observe every day. It's often called Newtonian physics. English physicist and mathematician Sir Isaac Newton (1642–1727), making observations about particles of matter, concluded that light was a particle. Here's why.



If you set up a board with a slit in it in front of a wall and shoot balls at it, say, paint balls, you would get an image on the wall the shape of the slit. If you put two slits in the board, you would get the image of two slits on the wall. And so on.

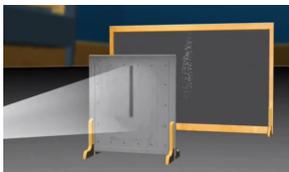


If you put the board in water and started a wave moving, when the wave hit the slit and radiated out, it would hit the back wall with the greatest intensity directly in line with the slit, similar to the line the paint balls make. But if you added a second slit, the waves would interfere with each other, so the points of greatest intensity would form an interference pattern of



multiple lines on the back wall. So far, so good, right?

But now let's go quantum, and look at the world of subatomic particles.



An electron (or in the case of light, a photon) is a tiny piece of matter, like a tiny paint ball. If we fire a stream of them at a board with a slit in it, we get the same pattern on the back wall as with the paint balls. When Newton did this with light, he observed the particle-like



display on the wall and concluded light was a particle. When Thomas Young added a second slit in the board and shined a light through it, he expected to get an image of two slits on the back wall. He was shocked to see that, instead, he got an interference pattern, like a wave. So he concluded that light was a wave.

But how can a particle form an interference pattern like a wave? A particle cannot be a wave and a wave cannot be a particle. Waves and particles are two entirely different forms of reality. Yet the light that passed through the slits seemed to be both. When we shoot electrons or photons through one slit, we get a particle pattern, and when we shoot them through two slits, we get a wave-like interference pattern. But electrons are particles, tiny pieces of matter. So how can an electron cause a pattern like a wave? There is no error in the experiment. It has been repeated all over the world for over 200 years with the same result. And it doesn't make sense.

But physicists are clever. They thought, maybe the electrons were somehow bouncing off each other and creating the interference pattern when they had to go through two slits. So they shot them through the two slits very slowly, one at a time. There is no way they could interfere with each other. But after an hour of this, the electrons fired at the two slits, one at a time, produced the same wave-like interference pattern on the screen. Physicists were completely baffled by this.

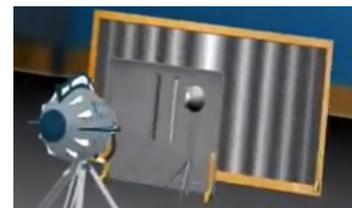
Understand that this is an information problem, not a logic problem. Logic says a thing and its opposite cannot both be true ( $A \neq \neg A$ ). Newton logically proved that light acts like a particle, and Young logically proved light also acts like a wave. There is no experiment which demonstrates that light is not a particle, or that light is not a wave. Both can even be proven mathematically. The problem is, logic gives us no way to understand **how** both can be true. The problem is one of insufficient information, not logic.

## **The Double-Slit Experiment Gets Really Weird— Reality Changes, Or Takes a Form, When You Look at It**

Let's return to our experiment. When electrons pass through one slit, they form a particle pattern. When they pass through two slits, they form a wave pattern. Particles are never waves, and waves are never particles. They are different forms of reality. So what exactly happens when the electron passes through two slits? How do they become something that produces an interference pattern, like a wave? As time went on, physicists were more capable of observation than they were in the early 1800s. By the early 1900s, physicists were able to put a small measuring device (something like a tiny camera) by the two slits to see what those electrons actually did when they passed through the slits.



As the particles passed through the slits, they somehow interfered with each other and made a wave-like pattern on the back wall, as usual. But when they turned on the camera, they observed something that has rocked the world of physics from that day forward. When they



began to record what happened, they got two slits on the back screen. The electrons, which were acting like waves, began to act like particles.

When they turned the camera off, the electrons went back to an interference (wave) pattern. The electrons acted differently with the camera on, as if they were aware they were being watched. But that's impossible. How can an electron know anything, let alone that it's being watched?

Then one day, whether purposefully or inadvertently I'm not sure, someone turned on the camera but not the recorder. So the camera was working, but the information was not being recorded. With this, the electrons continued to produce a wave-like interference pattern. So the camera was not the issue.

Nothing changed when the camera was on. But as soon as the physicists looked at the data (plugged in the device that recorded the information from the camera), the electrons displayed a particle pattern. This observation changed the world of physics forever. How could watching the electrons, instead of just watching the screen, change the outcome on the screen?

Theories began to form. Some say subatomic matter has no reality at all until it is observed. But what we can demonstrate to be particles have an observed wave form on a screen. It seemed like either we must think of each electron as a wave that hits both slits, or we have to think of the electron as splitting and going through each slit separately, or it goes through one slit or the other and splits, interfering with itself on the other side of the back screen. But then, how does the electron know a pair of slits is coming so it can split and go through both? And how can an electron split? Even if that were possible, it cannot be a wave and a particle at the same time, yet it is. And why are the results different simply because of the way they are observed? The conclusion was that, when it is observed, it goes through either one slit or the other, and when it is not observed, it seems to go through both, even though that makes no sense.

Some conclude that reality only exists for us when we look at it. But none of this is unique to the individual. Everybody everywhere, all over the world for over 200 years, observes the same thing. Also, it has been proven that human consciousness is not what causes the change. Experiments have shown that machines can also make the measurements. There is nothing special about consciousness. So what happens, really happens, independent of human observation of what happens?

Albert Einstein asked, “Do you really believe that the moon isn’t there when nobody looks?” Einstein called it “spooky action,” especially in reference to quantum entanglement, which we will not consider here. Einstein believed someday this would be explained in the realm of classical physics. Actually, it has been just the opposite. More experimentation only shows that making sense of the quantum results in classical terms is impossible.

## **The Double-Slit Experiment Gets Really, Really Weird— The Future Predicts the Past**

So far, we have learned that Quantum Physics has given us two paradoxical conclusions that make no sense in the world of classical (“Newtonian”) physics:

### **The First Paradox**

In the 1700s, Isaac Newton proved that light was a particle. Around the year 1800, Thomas Young proved that light was a wave. But a particle cannot be a wave, and a wave cannot be a particle. So logical conclusions (those based on reason applied to evidence) which contradict are part of science.

### **The Second Paradox**

In the early 1900s, various quantum physicists determined that light was either a particle or a wave, depending on whether or not people (or machines) look at it. So the form of matter changed when it was observed. That is not to say the observer determined the form. There were only two forms observed, but which of those it took depended on where the observation was made. So reality can have more than one material form depending on how it is observed.

### **Now, The Third Paradox**

Just before the year 2000 (1999), another shocking result was determined. Various experiments confirmed that the form a particle/wave took was dictated by the way it was measured in the future. So not only do we have causes determining effects (called determinism or causality, where the present

determines the future), but we also have the effects determining the cause (where the future determines the past).

### **The Experiments That Led to the Third Contradiction**

Around the turn of the 21<sup>st</sup> century, quantum physicists acquired the capacity to move the measuring device (camera) behind the slits. Without the measuring device, the light demonstrated a wave-like interference pattern on the back screen, as usual. When the measuring device was moved behind the slits and turned on, it measured the light as a particle that formed two slits, as before. The problem is, the light already came through the slits and was measured as a wave, and it had already produced an interference pattern on the back screen. But with the measuring device turned on, it showed a particle pattern, meaning that it had to come through the slits as a particle. So the recording, which took place after the light came through the slits, actually determined what form (waver or particle) the light took as it went through the slits. The present (or future) determined the past. Causality, determinism, and even free will are then called into question. Several theories have been suggested, but they all assume facts not in evidence, and none of them explain away the fact that the future event was determinative to what actually happened.

And this was not just done with light photons and electrons. In 2012, an Australian group of quantum physicists conducted an experiment using helium atoms which are much heavier and larger than light photons. Instead of slits, they shot the atoms through two grates with narrow slits made with lasers. What they found confirmed the photon experiment. When the atoms passed through the grates, they left a wave-like interference pattern on the back screen. But when they were measured, they took on a particle pattern, meaning the measurement determined the form they took through the grates. The present (or future) determined the past reality. Here is a report by Stephen Morgan, June 3, 2015, in "Science" [<http://www.digitaljournal.com>]:

Nevertheless, they expected the atom to behave just like light, meaning that it would take on both the form of a particle and/or a wave. This time they fired the atoms at two grate-like forms created by lasers, although the effect was similar to a solid grate.

However, the second grate was only put in place after the atom had passed through the first one. And the second grate wasn't applied each time, only randomly, to see how the particles reacted differently.

What they found was that, when there were two grates in place, the atom passed through it on many paths in a wave form, but, when the second grate was removed, it behaved like a particle and took only one path through.

So, what form it would take after passing through the first grate depended on whether the second grate was put in place afterward. Therefore, whether it continued as a particle or changed into a wave wasn't decided until a future event had already taken place.

Time went backwards. Cause and effect appear to be reversed. The future caused the past. The arrow of time seemed to work in reverse.

Think of it as a wave of water hitting two grates. The first grate produces an interference pattern that hits the second grate making even more interference on the back wall. But if the second grate is removed it should still produce an interference pattern, since it came through the first grate that way. It could only produce a particle pattern if it came through the first grate as a particle, which we know it didn't. But when the second grate is removed, it is recorded as a particle, meaning, it changed how it came through the first grate.

**The conclusion** to this third paradox is that time, as we know it, disappears. We know cause and effect is true. The past impacts the future. But at a subatomic level, the future determines the past.

## **Quantum Physics and the Bible**

**The Bible gives to history what quantum physics gives to science.** It gives us observations that must be superimposed upon seemingly contradictory, but equally verifiable, observations of the regular events in our three-dimensional world.

### **Three Fundamental Conclusions**

But some things seem clear. Quantum physics tells us that the subatomic particles that make up our world are collapsed, or disentangled from waves to particles, or from an indistinct form to waves or particles, simply by the act of observation. This has given us three deductions:

- 1. There are logically determined conclusions that contradict one another.**
- 2. The way matter is observed can determine what form it will take.**
- 3. The future form of matter can determine its past reality.**

This is all at the subatomic level. But since everything is made up of these subatomic particles, the reality of everything we know might just depend it. This is an extreme break from the idea of a constant reality, or one where the laws of classic (Newtonian) physics define all the answers.

### **The Biblical Significance of the Discoveries of Quantum Physics**

I'd like to ask the question, "Do these quantum physics experiments coincide with biblical teaching?" It seems that they do.

There is a sense in which Bible believers could say to quantum physicists,  
"What's the big deal, we've always known that."

#### **1. Biblical Paradoxes**

Let's look at some parallels between the double-slit experiments and biblical theology. Consider the biblical idea of predestination and free will. The Bible clearly teaches that God predestines the salvation of those who will be saved (Romans 8–9; Ephesians 1). The Bible also teaches that those who are saved make a real, free will, choice to believe in Christ (John 1:12; 3:16; 5:24; Romans 10:10). We also learn that God predestines the events of history (Isaiah 37:26; 48:3), and we are told things happen by chance (Ecclesiastes 9:11; Luke 10:31). But how can that be? There is no way the same event can be both predestined and a free will choice (or chance) event. The same would hold true for the doctrines of the unity and Trinity of God, the 100% humanity and 100% Deity of Christ, the historical account of biblical miracles and the impossibility of them occurring in the natural world. These are not logical contradictions, but they are incompatible conclusions.

Understand, there are no logical problems in the Bible. Logic says a thing and its opposite cannot both be true.  $A \neq \neg A$ . The Bible says God predestines salvation, it never says God does not predestine salvation. The Bible says we have free will to choose salvation, it never says we do not have free will to choose salvation. The Bible says God is one, and the Bible describes three persons of the godhead, who

are called God. The Bible never says God is not one, or that the Son and the Spirit are less than God. We cannot understand **how** both things can be true, yet they are, logically.

### **"Faith" According to Quantum Physics, and "Faith" According to the Bible**

Quantum physicists and the authors of the Bible have the same definition of faith—to trust verifiable evidence. Quantum physicists believe (trust the evidence) that subatomic structures like photons, electrons, and atoms themselves, can be measured in particles and waves, even though there is no way to know how that is possible. The authors of the Bible believe that salvation comes about both by predestination and free will choice, even though there is no way to know how that is possible.

Let's take another example. The faith (trusting the evidence) that physicists have in the results of the double-slit experiment is the same kind of faith (trusting the evidence) required to believe in the resurrection of Jesus of Nazareth. Resurrection cannot happen in the physical (three-dimensional) world, but the only reasonable way to evaluate the historical evidence is to say that it did. There is no contradiction here. There is no experimental evidence that says people rise from the dead in the physical world, and there is no historical evidence that says Jesus didn't. The faith that Jesus rose from the dead is exactly the same (by way of definition) as the faith that the same photons or electrons make both particle and wave patterns on a screen.

Quantum physics believes in logically-determined evidence, even when it seemingly contradicts, as does the Bible. The only difference is, quantum physics uses scientific experiments, and the Bible uses historical data. As scientists go about doing experiments, there are no unexplainable events until they come to something like quantum physics. In the same way, as historians go about making observations, there are no unexplainable events until they come to the Bible. Unlike religious superstition, the Bible is a book of historical events in the real world, documented in real time.

## **2. Transformational Miracles**

Another parallel is in the area of transformational miracles (where the observations in the three-dimensional-world changed when the observer was allowed to see it in a different way). The Bible has several examples. One is when the king of Aram was trying to kidnap Elisha because Elisha warned the king of Israel about the Aramean attacks. We read,

*And it was told him [the king of Aram], saying, "Behold, he [Elisha] is in Dothan." He sent horses and chariots and a great army there, and they came by night and surrounded the city. Now when the attendant of the man of God had risen early and gone out, behold, an army with horses and chariots was circling the city. And his servant said to him, "Alas, my master! What shall we do?" So he answered, "Do not fear, for those who are with us are more than those who are with them." Then Elisha prayed and said, "O LORD, I pray, **open his eyes that he may see.**" And the LORD **opened the servant's eyes and he saw**; and behold, the mountain was full of horses and chariots of fire all around Elisha (2 Kings 6:13-17).*

So, where were all those *chariots of fire* a few minutes before Elisha's servant saw them? The answer is, they were already there, in the same place as they were after Elisha's servant saw them. What changed was simply that Elisha's servant was allowed to see them. Or we might say that he was allowed to observe the same thing a different way. *The LORD opened the servant's eyes and he saw.* The observer became part of the observation. He saw something different (and apparently contradictory) to what was observable before. The wave (the enemy chariots) became ("collapsed into") particles (the *chariots of fire*) when observed differently. This was not a private subjective experience. The observation of Elisha's servant did not create the chariots of fire. It was an objective reality, which Elisha could already

see. But the observation changed when there was a change (the servant became part of the equation) in the way the observer was able to see (measure) the reality.

Here is one more example.

*Jesus took with Him Peter and James and John his brother, and led them up on a high mountain by themselves. And He was transfigured before them; and His face shone like the sun, and His garments became as white as light. And behold, Moses and Elijah appeared to them, talking with Him. Peter said to Jesus, "Lord, it is good for us to be here; if You wish, I will make three tabernacles here, one for You, and one for Moses, and one for Elijah." While he was still speaking, a bright cloud overshadowed them, and behold, a voice out of the cloud said, "This is My beloved Son, with whom I am well-pleased; listen to Him!" When the disciples heard this, they fell face down to the ground and were terrified. And Jesus came to them and touched them and said, "Get up, and do not be afraid." And lifting up their eyes, they saw no one except Jesus Himself alone (Matthew 17:1-8).*

During their trip north to Caesarea Philippi, Jesus took three of His disciples up to a *high mountain* and something happened that was not an observation anyone would make in our macro-physical, three-dimensional world. *Jesus was transfigured before them; and His face shone like the sun, and His garments became as white as light. And behold, Moses and Elijah appeared to them, talking with Him.* One minute the three disciples saw Jesus in the macro physical three-dimensional world, the next minute they saw Him in a different world. There was a connection between the observation and the observers. What they saw (like particles instead of waves) changed because their observation was allowed to change. But this was no private subjective experience. The observers did not create the reality. It was a real observation that all three disciples made objectively. Peter later wrote about it, telling us it was real, objective, and that it came from *heaven*.

*For we did not follow cleverly devised tales [faith without evidence] when we made known to you the power and coming of our Lord Jesus Christ, but we were eyewitnesses [faith in the evidence] of His majesty. For when He received honor and glory from God the Father, such an utterance as this was made to Him by the Majestic Glory, "This is My beloved Son with whom I am well-pleased" — **and we ourselves heard this utterance made from heaven** when we were with Him on the holy mountain (2 Peter 1:16-18).*

The Bible also tells us about things like the conjuring up of Samuel from the dead, Baalam's speaking donkey, God's revelations to Moses at Mount Sinai, Elijah's chariot of fire, Ezekiel's vision by the river Chebar, Isaiah's vision of the heavenly temple, Jesus' baptism, Paul's conversion, and John's revelation of the apocalypse. Experiences like these seem to be a change in observation based upon a change in the perspective of the observer. The reality did not change. What was actually observed was a part of reality (a different dimension or a different universe or realm) that was unobservable before.

Of course, we don't know if the biblical transformation miracles are the same as the quantum physics observations. But they illustrate the same thing.

And quantum physics includes (without knowing it or admitting it) a biblical view of faith, trusting verifiable observations, even when the reality changes with the presence of the observer. The difference is not in the experimental results but in the theories about those results. Reality does not change, truth does not change, but what is actually observed changes to something not possible in the physical three-dimensional universe, when the observer is able to make a different observation.

### 3. Prophecy

A third area of application is in the area of eschatology, that is, future prophecy. The extension of the double-slit experiment and other testing done in 1999 and 2012 demonstrated that the form a particle/wave took was dictated by the way it was measured in the future. So not only do we have causes determining effects (called determinism or causality, where the present determines the future), but we also have the effects determining the cause (where the future determines the past).

It's the same in the Bible.

#### **Causality is a basic teaching in both testaments.**

- Joshua 1:7 *Only be strong and very courageous; be careful to do according to all the law which Moses My servant commanded you; do not turn from it to the right or to the left, so that you may have success wherever you go.*
- Proverbs 10:4 *Poor is he who works with a negligent hand, But the hand of the diligent makes rich*
- Ezekiel 18:31-32 *For why will you die, O house of Israel? For I have no pleasure in the death of anyone who dies," declares the Lord GOD. "Therefore, repent and live.*
- Matthew 5:3 *Blessed are the poor in spirit, for theirs is the kingdom of heaven.*
- Galatians 6:7 *Do not be deceived, God is not mocked; for whatever a man sows, this he will also reap.*

Causality is clear in the Bible. What we do definitely impacts our future. Our actions are a cause, and the future is a result.

#### **But God also said He has the future laid out ahead of time.**

- Proverbs 16:33 *The lot is cast into the lap, But its every decision is from the LORD.*
- Isaiah 37:26 *Have you not heard? Long ago I did it, From ancient times I planned it. Now I have brought it to pass*
- Ephesians 1:4 *just as He chose us in Him before the foundation of the world*
- Romans 9:16 *So then it does not depend on the man who wills or the man who runs, but on God who has mercy.*
- Matthew 24:25 *Behold, I have told you in advance.*
- Revelation 1:17-19 *Do not be afraid; I am the first and the last, and the living One; and I was dead, and behold, I am alive forevermore, and I have the keys of death and of Hades. Therefore write the things which you have seen, and the things which are, and the things which will take place after these things.*

The things which God has laid out ahead of time are all in His plan, including our decisions. The plan of God was before the foundation of the world, and everything is going toward that end. He has planned the lives of each one of us and for the end of the world. That plan then dictates from the future what will happen in the past and the present. *For God has put it in their hearts to execute His purpose...until the words of God will be fulfilled* (Revelation 17:17). The people who are not saved unto eternal life are those who have not received Christ. But those are also the ones *whose name has not been written from the foundation of the world in the book of life of the Lamb* (Revelation 13:8).

## Conclusion

The faith called for in the Bible is a decision to trust reasonable evidence. No other religion offers that definition of faith. All other religions define faith as trust in things contrary to evidence. But the biblical concept of faith is the same as that used by the scientific method. Science asks us to believe in the laws

of gravity, thermodynamics, motion, friction, speed, etc. The Bible asks us to trust the evidence for creation, a global flood, the establishment of the Hebrew people, the coming of Jesus as the Messiah, and establishment of the church through the apostles. Just as macro (Newtonian) physics establishes truth about our natural world, so the Bible establishes truth about a certain part of the history of our world. And both do it by asking us to place faith in reasonable evidence. Scientific evidence can be confirmed in the laboratory, historical biblical evidence can be confirmed by anyone willing to visit the tells in Israel.

But the Bible also tells us that God interrupted the natural course of events with revelation in the form of supernatural events. Supernatural events cannot happen in the natural world, yet they did. The Bible is not a book of religious fairy tales, it's a historical record of what God did throughout history, including a penetration of nature with the supernatural. The Bible provided evidence all along the way. Today, we can study that evidence to see if it is reasonable. We can also see that reason applied to studies like textual analysis, archeology, history, astronomy, geology, and biology all confirm the truth of the Bible.

So the natural and supernatural history recorded in the Bible is confirmed logically, rationally, and with reason applied to real evidence. But that's a paradox in the natural world, since nature, by definition, cannot be supernatural. The Bible also asks us to believe in paradoxical conclusions like the sovereignty of God and the free will of man, the unity and trinity of God, the humanity and deity of Christ, and prophetic prediction of future events, which govern our present and past actions.

So can faith in things that seem to contradict one another, fit the definition of "trusting reasonable evidence?"

Science through most of history would say, "No, all logical conclusions must make sense with all other logical conclusions." Then came quantum physics. With the double-slit experiment and all that followed, on to today's sophisticated atomic experiments with lasers, physicists have been forced to define faith like the Bible does, trusting reasonable evidence, even when that evidence seems to contradict other reasonable evidence.

- Things that can't logically be true are real (waves can't be particles and particles can't be waves, yet they are).
- Physical reality changes depending on how we look at it (waves can't change to particles just because we look at them, but they do).
- Future events predict past events (observation of the present form of an atom or electron can't change what it was in the past, yet it does).

So now scientific faith has to change to be the same as biblical faith, trusting reasonable evidence, even when that evidence seems to contradict what we know about the macro, physical, natural world.

We might even call it, "Faith in the supernatural."