Spirituality and Science

Can we have a belief in Spirituality and Science or do the two, completely contradict each other?

If Spirituality is based on faith and belief alone, if it is unchangeable and abides strict rules and can not grow, then it would be a contradiction.

Religion however, is based on faith and belief alone, is unchangeable and abides strict rules and cannot grow, it is religion that contradicts science, and has always done so. It is Religion that for thousands of years has kept scientific thinkers locked away. It is Religion that has executed scholars because their scientific findings were looked upon as heresy.

Spirituality is not a Religious believe, but is the seeking of higher levels of experience, asking the deepest questions, and seeking the true "self."

Spirituality is in no way contrary to science. In fact, since science is such a productive method of discovering new truths, it can be used for spiritual exploration and discovery.

After all, there can only be one truth that explains creation and our evolving universe, but there may be many pathways, to reveal one truth.

So how does Science view Spirituality?

Historically science has been rejected, humiliated, persecuted and ridiculed, but today it enjoys the freedom to discover and develop.

But as soon as scientific academic institutions were established they rejected and ridiculed anything spiritual, if it could not be proven by a mathematical formula it couldn't be true.

Science dealt with mass as mass, and ignored all spiritual matters, but things are changing. Just as religion had to succumb to scientific knowledge, so now, science is beginning to unravel the mysteries of the universe with Quantum Physics and their latest findings are stretching science into the realms of spirituality.

A Quantum View

Quantum Science is going beyond the probe of atoms, and exploring the weird and wacky. New words are entering science, new ideas, theories and dimensions, String Theory (dancing, unobservable, vibrational waves of energy) and Membrane Theory (Multiple universes, carved up into slices, living side by side, all conduced by?) are giving room to explore what is known as the M-theory which is undertaking to prove the unity of Gravity, Electromagnetism, Weak and Strong nuclear forces.

The deeper Quantum Physicists explore, the closer they encircle metaphysical philosophy. They are realizing there are higher realities within infinite dimensions of intelligent vibrational energy.

Some theorists claim to have uncovered eleven dimensions to our universe. Some Quantum Physicists even go so far as to state the dimensions of the universe may be infinite. At the same time they are theorizing on parallel universes that live side by side with our universe. Perhaps an infinite number of universes?

If this is proven to be true it will explain why our world was not formed by chance, for if there is an infinite number of universes, then it stands to common sense at least one would contain intelligent life as found here on earth. It can be no fluke, because of the infinite variety of universes. The formula to create our universe must differ from each and every other universe, in the same manner as no two humans are identical and each has their own free will to act within an inescapable framework.

The Wacky World of Quantum Science

Einstein was one of the first to go Quantum, here are some of his ideas and theories, which have become Law.

Your body contains trillions of atoms, of many different elements. There are atoms of hydrogen and oxygen, carbon and nitrogen,...but your body also contains many atoms of calcium, nickel, potassium, iron...even gold!

In all, there are 92 different types of atoms, most of which can be found in the molecules that make up the tissues of your body.

Since we know that when the universe formed, the only elements around were hydrogen and helium, where did all these other types of atoms come from? The answer is quite startling...all of the atoms in your body, other than helium and hydrogen, were manufactured in the center of a supernova...a star that once existed, but destroyed itself in a gigantic explosion!

To understand how this is possible, we need to look at what atoms are.

The simplest atom is hydrogen, which contains a nucleus composed of one proton, circled by one moving electron. The next simplest atom, helium, has a nucleus with 2 protons, and is circled by 2 electrons.

The biggest naturally occurring atom is uranium, with 92 protons, and 92 electrons. (For simplicity, we will ignore the fact that these atoms also contain neutrons in their nuclei.)
It is possible for small atoms to combine to form bigger ones...but only under intense heat and pressure...the millions of degrees found in the center of a star. This process is called nuclear fusion.

Large stars will be so hot in their interior that hydrogen atoms are forced together to form helium atoms, helium atoms are forced together to form still larger atoms,...and so on. Eventually, large stars will contain in their interior, shells of many different heavier atoms, some as big as iron (57 protons).

If the star is large enough, when it runs out of fuel it will collapse in on itself. The relatively cooler outer layers hit the incredibly hot interior, and a massive explosion occurs, called a supernova. Stars that do this don't live very long...while a smaller star like our sun may burn for tens of billions of years, a massive star that is destined to become a supernova may burn out and explode in a matter of a few million years...a ten-thousandth of the lifetime of our sun.

During this explosion, temperatures rise once again; coupled with intense pressure, this is enough energy to force larger atoms to combine, creating all of the heavier elements from iron to uranium!

This explosion is so large that it propels the contents of the star out into space...including all the heavy elements it has made. Vast clouds of atoms of all types remain, where once there was a star.

We know that at the beginning of the universe, there was only hydrogen and helium. Massive stars formed from these gases, burned out in a few million years, and spewed the heavy elements they created into space around them.

This process has occurred over and over since the universe began some 17 billion years ago. We can observe it still happening today, in our large telescopes.

When our star (the sun) and its family of planets formed from interstellar gases some 5 billion years ago, those gases were already well seeded with heavy elements formed in supernovas that occurred in our interstellar neighbourhood in the previous 12 billion years. All of the heavier elements that went into forming the earth, the ground, the biosphere,... everything... came from this interstellar gas cloud. And so did all the elements in your body!

E=MC2

Albert Einstein is perhaps the most famous scientist of this century. One of his most well-known accomplishments is the formula E=MC2

Despite its familiarity, many people don't really understand what it means.

One of Einstein's great insights was to realize that matter and energy are really different forms of the same thing. Matter can be turned into energy, and energy into matter.

For example, consider a simple hydrogen atom, basically composed of a single proton. This subatomic particle has a mass of 0.000 000 000 000 000 000 000 000 001 672 kg. This is a tiny mass indeed. But in everyday quantities of matter there are a lot of atoms! For instance, in one kilogram of pure water, the mass of hydrogen atoms amounts to just slightly more than 111 grams, or 0.111 kg.

Einstein's formula tells us the amount of energy this mass would be equivalent to, if it were all suddenly turned into energy. It says that to find the energy, you multiply the mass by the square of the speed of light, this number being 300,000,000 meters per second (a very large number): = 0.111 x 300,000,000 x 300,000,000 = 10,000,000,000,000,000 Joules

This is an incredible amount of energy! A Joule is not a large unit of energy ... one Joule is about the energy released when you drop a textbook to the floor. But the amount of energy in 30 grams of hydrogen atoms is equivalent to burning hundreds of thousands of gallons of gasoline!

If you consider all the energy in the full kilogram of water, which also contains oxygen atoms, the total energy equivalent is close to 10 million gallons of gasoline!

Can all this energy really be released? Has it ever been?

The only way for ALL this energy to be released is for the kilogram of water to be totally annihilated. This process involves the complete destruction of matter, and occurs only when that matter meets an equal amount of antimatter ... a substance composed of mass with a negative charge.

Antimatter does exist; it is observable as single subatomic particles in radioactive decay, and has been created in the laboratory. But it is rather short-lived (!), since it annihilates itself and an equal quantity of ordinary matter as soon as it encounters anything. For this reason, it has not yet been made in measurable quantities, so our kilogram of water can't be turned into energy by mixing it with "antiwater." At least, not yet.

Another phenomenon peculiar to small elementary particles like protons is that they combine. A single proton forms the nucleus of a hydrogen atom. Two protons are found in the nucleus of a helium atom. This is how the elements are formed ... all the way up to the heaviest naturally occurring substance, uranium, which has 92 protons in its nucleus.

It is possible to make two free protons (Hydrogen nuclei) come together to make the beginnings of a helium nucleus. This requires that the protons be hurled at each other at a very high speed. This process occurs in the sun, but can also be replicated on earth with lasers, magnets, or in the center of an atomic bomb. The process is called nuclear fusion.

What makes it interesting is that when the two protons are forced to combine, they don't need as much of their energy (or mass). Two protons stuck together have less mass than two single separate protons!

When the protons are forced together, this extra mass is released ... as energy! Typically this amounts to about 7% of the total mass, converted to an amount of energy predictable using the formula.

Elements heavier than iron are unstable. Some of them are very unstable!

This means that their nuclei, composed of many positively charged protons, which want to repel from each other, are liable to fall apart at any moment!

We call atoms like this radioactive.

Uranium, for example, is radioactive. Every second, many of the atoms in a chunk of uranium are falling apart. When this happens, the pieces, which are now new elements (with fewer protons) are LESS massive in total than the original uranium atoms. The extra mass disappears as energy ... again according to the formula! This process is called nuclear fission.

Manhattan Project

Both these nuclear reactions release a small portion of the mass involved as energy. Large amounts of energy! You are probably more familiar with their uses. Nuclear fusion is what powers a modern nuclear warhead. Nuclear fission (less powerful) is what happens in an atomic bomb (like the ones used against Japan in WWII), or in a nuclear power plant.

Albert Einstein was able to see where an understanding of this formula would lead. Although peaceful by nature and politics, he helped write a letter to the President of the United States, urging him to fund research into the development of an atomic bomb ... before the Nazis or Japan developed their own first. The result was the Manhattan Project, which did in fact produce the first tangible evidence of ... the atomic bomb!

Einstein's also came up with ideas about time, the Theory of Relativity.

Strange things can happen when you move Fast...things you won't learn about in high school courses, and won't experience while driving down the road in your pick-up. But these things are still very real, and definitely Weird!

Light rays travel very quickly...they cover about 300,000 kilometres every second.

This is as fast as anything can travel; nothing can move as fast as light particles.

But if it were possible to build a very powerful vehicle that could move almost as fast as light...perhaps 200,000 km every second...then anyone observing this vehicle as it flashed past would notice some extremely peculiar things happening to it.

The vehicle would appear shorter than normal, and in fact, it would be shorter. If the vehicle were ordinarily 3 metres long, it might now be only 2 metres in length. If you were able to weigh the vehicle, you would discover that it weighed much more than normal. Anybody riding in it would weigh many times their normal weight.. However, the people in the vehicle would not feel any heavier, or any thinner. They would feel and look normal to themselves...but if they looked out the window, they would see the rest of the world moving by, and it would appear to be shrunk.

If the vehicle were to move faster and faster, getting closer and closer to the speed of light, it and the people in it would continue to get thinner and thinner, while at the same time getting heavier and heavier! These strange occurrences, as described by Albert Einstein, can actually be observed.

It is not yet possible to build a vehicle that will go this fast, of course...the fastest spacecraft only cover about 15-20 kilometres in a second. But tiny particles called 'cosmic rays' that are given off by the sun...the ones that cause the Northern Lights when they hit earth's magnetic field...move almost as fast as light, and their mass can be measured. When they move that fast, their mass IS much heavier than normal.

A much more dramatic effect of moving fast is what happens to time. It seems that the faster you move, the more slowly time runs!

At normal, every-day speeds (airplane speed, for instance), the effect of 'time slowing down' is just barely measurable. You could fly non-stop around the world in an airplane, and because of your increase in speed, time would run slower for you. Everyone on the plane, all the watches and clocks, the plane itself...all would be a small fraction of a second younger than if they had not gone anywhere! That experiment has been done. Want to live longer? Spend lots of time on high-speed planes, and time will move more slowly for you. You might live 2 seconds longer than you would have if you'd stayed on the ground.

Things get much more interesting if you fly off in a spacecraft that can go really fast...perhaps 200.000 km per second. Now time is really slowing down. Suppose you and a friend are both exactly 16 years old. He stays on earth, but you go off for a trip in our very fast spacecraft. Fifty years go by on earth. (It's a long way to the nearest stars!) You return to find your friend is now 65 years old. You, however, have experienced a phenomenon known as time dilation. Time has been running more slowly for you, in the fast-moving spacecraft. According to you, the trip took only ten years...and you are just 26 years old!

This effect would seem impossible...yet it has been demonstrated to be a fact. Once again, small particles can be observed and measured. Many are radioactive, which means they disintegrate with clockwork precision. The time it takes them to disintegrate can be accurately measured. When these particles are accelerated to high ('relativistic') speeds as in our example above, they live longer before disintegrating!

It has been almost 100 years since these theories were first put forward by Einstein and others, and since then they have become accepted as fact by scientists world-wide. More evidence of their validity is also apparent from studies of objects in far distant space.

Uncertainty Principle

Quantum Physics and their latest findings are stretching science into the realms of metaphysical principles.

In ancient Greece there was a controversy about the nature of light. Euclid, Ptolemy and others thought that "light" was some sort of ray that travels from the eye to the observed object.

The atomists and Aristotle assumed the reverse. Nearly 800 years after Ptolemy, circa 965 CE, in Basra in what is now Iraq, Abu Ali al-Hasan Ibn al-Haytham (Alhazen) settled the controversy with a clever argument. He said that if you look at the Sun for a long time you will burn your eyes: this is only possible if the light is coming from the Sun to our eyes, not vice versa.

In 1672 another controversy erupted over the nature of light: Newton argued that light was some sort of a particle, so that light from the sun reaches the earth because these particles could travel through the vacuum.

Hooke and Huygens argued that light was some sort of wave. In 1801 Thomas Young put the matter to experimental test by doing a double slit experiment for light.

The result was an interference pattern. Thus, Newton must have been wrong: light had to be a wave.

The double-slit experiment contains a lot of the best aspects of the weirdness of quantum physics, for example a light shining through a small hole or slit (like in a pinhole camera) creates a spot of light on the screen (or film, or detector). However, light shown through two slits that are close together creates not two spots on the screen, but rather a series of alternating bright and dark lines with the brightest line in the exact middle of this interference pattern.

This shows that light is a wave since such a pattern results from the interference of the waves coming from each slit.

However, in the year 1900 physicist Max Planck showed that certain other effects in physics could only be explained by light being a particle. Many experiments followed to also show that light was indeed also a particle (a "photon") and Albert Einstein was awarded the Nobel Prize in physics in 1921 for his work showing that the particle nature of light could explain the "photoelectric effect."

This was an experiment whereby low energy (red) light, when shining onto a photoelectric material, caused the material to emit low energy (slow moving) electrons, while high energy (blue) light caused the same material to emit high energy (fast moving) electrons.

However, lots of red light only ever produced more low energy electrons, never any high-energy electrons.

In other words, the energy could not be "saved up" but rather must be absorbed by the electrons in the photoelectric material individually. The conclusion was that light came in packets, little quantities, and behaved thus as a particle as well as a wave.

So light is both a particle and a wave. OK, kind of unexpected, but perhaps not totally weird.

But the double slit experiment had another trick up its sleeve. One could send one photon (or "quantum" of energy) through a single slit at a time, with a sufficiently long interval in between, and eventually a spot builds up that looks just like the one produced when a very intense (many photons) light was sent through the slit.

But then a strange thing happened. When one sends a single photon at a time (waiting between each laser pulse, for example) toward the screen when both slits are open, rather than two spots eventually building up opposite the two slit openings, what eventually builds up is the interference pattern of alternating bright and dark lines!

Hmm... how can this be, if only one photon was sent through the apparatus at a time?

The answer is that each individual photon must - in order to have produced an interference pattern -- have gone through both slits!

This, the simplest of quantum weirdness experiments, has been the basis of many of the unintuitive interpretations of quantum physics.

We can see, perhaps, how physicists might conclude, for example, that a particle of light is not a particle until it is measured at the screen. It turns out that the particle of light is rather a wave before it is measured. But it is not a wave in the ocean-wave sense.

It is not a wave of matter but rather, it turns out that it is apparently a wave of probability. That is, the elementary particles making up the trees, people, and planets -- what we see around us -- are apparently just distributions of likelihood until they are measured (that is, measured or observed).

So much for the Victorian view of solid matter!

Matter Being Empty

The shock of matter being largely empty space may have been extreme enough -- if an atom were the size of a huge cathedral, then the electrons would be dust particles floating around at all distances inside the building, while the nucleus, or center of the atom, would be smaller than a sugar cube.

But with quantum physics, even this tenuous result would be superseded by the atom itself not really being anything that exists until it is measured.

One might rightly ask, then, what does it mean to measure something? And this brings us to the Uncertainly Principle first discovered by Werner Heisenberg.

Dr. Heisenberg wrote, "Some physicist would prefer to come back to the idea of an objective real world whose smallest parts exist objectively in the same sense as stones or trees exist independently of whether we observe them. This however is impossible."

Entanglement

Entanglement is a strange feature of quantum physics, the science of the very small.

It's possible to link together two quantum particles – photons of light or atoms, for example – in a special way that makes them effectively two parts of the same entity.

You can then separate them as far as you like, and a change in one is instantly reflected in the other. This odd, faster than light link, is a fundamental aspect of quantum science – Erwin Schrödinger, who came up with the name "entanglement" called it "the characteristic trait of quantum mechanics."

Entanglement is fascinating in its own right, but what makes it really special are dramatic practical applications that have become apparent in the last few years.

Is it possible that entangled particles are not actually in immediate communication, but are simply programmed to behave in the same way? Much like twins separated at birth who live eerily similar lives - assume the same professions or marry similar spouses.

So what is Entanglement?

If you take some property of a particle, the equivalent of color, say the spin of an electron, it doesn't have the value pre-programmed. It has a range of probabilities as to what the answer might be, but until you actually measure it, there is no fixed value.

What happens with a pair of entangled electrons is you measure the spin of one. Until that moment, neither of them had a spin with a fixed value. But the instant you take the measurement on one, the other immediately fixes its spin (say to the opposite value).

These quantum bits were every possible color until you looked at one. Only then did it become pink, and the other instantly took on another color.

Einstein among other scientists could not accept quantum entanglement. It seems to throw out the whole notion of cause and effect, so how confident are physicists that quantum entanglement exists and what are the implications for science and the scientific method?

Einstein had problems with the whole of quantum physics – which is ironic, as it was based on his Nobel Prize winning paper on the photoelectric effect. What he didn't like was the way quantum particles don't have fixed values for their properties until they are observed – he couldn't relate to a universe where probability ruled.

That's why he famously said that God doesn't play dice. I think an even better quote, less well known, was when he wrote:

"I find the idea quite intolerable that an electron exposed to radiation should choose of its own free will, not only its moment to jump off, but also its direction.

In that case, I would rather be a cobbler, or even an employee in a gaming house, than a physicist."

Einstein believed that underneath these probabilities were fixed, hidden realities we just couldn't see. That was why he dreamed up the idea of entanglement in 1935.

It was to show that either quantum theory was incomplete, because it said there was no hidden information, or it was possible to instantly influence something at a distance. As that seemed incredible, he thought it showed that quantum theory was wrong.

It did take a long time to prove that entanglement truly existed.

It wasn't until the 1980s that it was clearly demonstrated. But it has been shown without doubt that this is the case.

Entanglement exists, and is being used in very practical ways.

Entanglement doesn't throw away the concept of cause and effect. But it does underline the fact that quantum particles really do only have a range of probabilities on the values of their properties rather than fixed values. And while it seems to contradict Einstein's special relativity, which says nothing can travel faster than light, it's more likely that entanglement challenges our ideas of what distance and time really mean. Similarly, entanglement is no challenge to the scientific method.

We need to use a different kind of math, but this is still the same science.