

Fusion

Capturing a Piece of the Sun



Ingredients; Unlimited Energy
 Unlimited Dreams

www.fusion4freedom.com



Have you ever wondered how the sun keeps burning for such a long time? The sun was burning when your parents were just babies. It was burning way back when your grandparents were first born. It was also burning when dinosaurs walked the Earth. How does it keep burning so bright without just turning into a bunch of ashes?

We have all seen fire. If you think about a fire, perhaps in a back yard barbecue or fireplace, you may wonder how such a little fire can put off so much heat and light.

To see how a fire works, you can ask yourself what it takes to make a fire. The fire always requires a fuel, which is something that can burn. In a fireplace or campfire this might be pieces of wood. So you always need some fuel, but what you can't see is the fire also needs the air around it.



If you light a candle and set a glass jar over it, the candle flame will soon start to get smaller and then it will go out. This is because the air is joining together with the fuel to make it burn and it soon runs out of air. In the case of a candle, it is the wax that is the fuel. There may still be plenty of wax left to burn, but with the glass over it, all the air gets used up.

So let's go back to the sun now. The sun is great big, over a million Earths could fit into the sun. So is the sun a giant ball of wood or charcoal that has a super-gigantic atmosphere of air around it to keep it burning? Wouldn't the air be used up pretty fast if the whole surface of the sun was burning like a giant forest fire? Just think of all the smoke. If the sun was burning with the

kind of fire we use on Earth, the smoke would also block out most of the light from reaching the Earth. Also, remember that the sun is around 93 million miles away. Even if the sun was a giant piece of burning wood, that is way too far away to feel the heat from even a sun-sized campfire.

So, don't worry, the Sun is not burning with the kind of fire you are used to and it is not getting ready to go out like a candle in a jar, because the sun is burning with a very different kind of fire. This kind of fire is called fusion and it doesn't have anything to do with fuel joining with air, or we would all be in real trouble.

How different is this fusion fire that we find on the sun? If we burn one match with the normal kind of fire, we get about 6000 units of energy. That is a good amount of heat energy, enough to burn our fingers. But if we burned the same amount of material that was in the match, using the fusion kind of fire, it would give off around 81,000,000,000 units of energy. Do you see the difference? Just a little bit of material will produce a giant amount of energy using fusion.

That is why it is so important that we learn to use the energy of fusion. We have to burn a great deal of fuel in gasoline, oil and coal every day to give people the energy we need. But with fusion we would only need to burn a little bit of fuel every day, so our fuel will last for millions of years, just like it does on the sun.

Every year the world burns over 10 billion tons of fossil fuels. In 2004 the U.S. used enough crude oil to fill over 10.5 million railroad tank cars, which would stretch between Miami and Seattle (3,300 miles) over 36 times.

That is why we need to do the research and experiments needed to bring fusion to a place we can all use it on Earth. Just as the Sun cannot burn its fuel with a normal fire and last very long, we cannot burn oil and coal using the normal fire and be able to keep it up for very long.



The same amount of energy that is in 21,000 rail cars of coal or 10 million barrels of oil can be replaced with only one small pickup load of fuel using fusion energy.

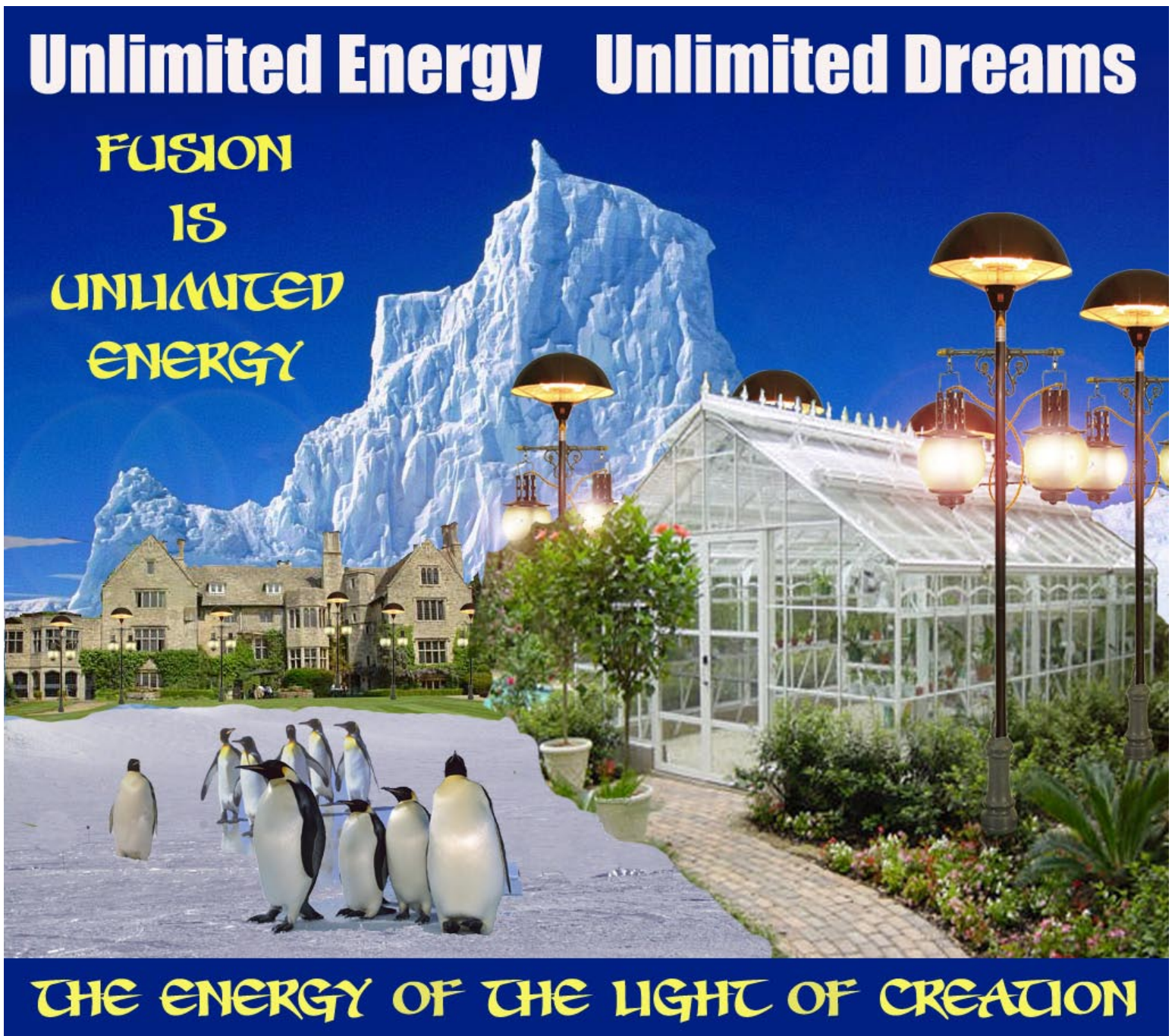
Also, fusion doesn't pollute and it is safe. Remember how we said that if the sun was powered by normal fire it would be so full of smoke the light couldn't get out? Isn't using the normal kind of fire to power our cars and factories also producing too much smoke and pollution?

This is why we are working so hard to get our country to put money into fusion research, so we don't have to keep burning large amounts of fuel that pollutes the world. We want to burn a little bit of fuel using fusion so that our energy supply will last for millions of years.

With fusion energy we can feed the world and power machines to turn sea water into fresh drinking water and to irrigate food crops around the world.

Fusion holds the promise for a bright future for us all. There is no other source of energy in the world that can feed the hungry and that holds the promise of a bright future for people to live happy lives without pollution.

Now we will show you just what fusion can bring to the world.
Fusion is the energy and light of all the stars in the universe.
Fusion is the energy of the light of creation.



Everyone needs to eat, but there are only certain places on Earth that are really good for growing enough food. In many areas only a small amount of crops can be raised. There are different reasons that some parts of the world can't raise enough food. In some places, the weather is too cold for plants to grow well.

In these cold climates, fusion would allow us to heat greenhouses. We could cover large areas with clear plastic greenhouses to grow food all year round by the warmth of fusion. Where would we get all that clear plastic you might ask. That is what is so amazing about fusion. Since plastic is made from petroleum, such as oil and gas, once fusion is used to power things there will be so much oil left over that it will become very

inexpensive. It won't be used to make gasoline for your car anymore, so billions of gallons will be just sitting there waiting for another use. The companies that make plastic will not have to pay very much to buy all that extra petroleum, so the cost of making greenhouses will be much lower than it is now with our high energy prices.

In other places around the world the food can't be grown because there is not enough water to irrigate the farms. Yet, even in these deserts there is usually an ocean of water nearby that could be used to irrigate, if it wasn't for the salt in the sea water. There are ways to take the salt out of the water, but they require a lot of energy. Fusion energy would be able to power these machines to take out the salt and also power the pumps to carry the fresh water through the pipes to the farms. These pipes would also be made from the low cost plastic, thanks to fusion.

In many places there is starvation and poverty even though the weather is warm and there is enough water to grow crops. This is because of war and terrorism. Many of the wars are fought over oil, since every nation needs energy to keep things moving. Once we have fusion there will not be any more wars over oil. Oil will be used to lubricate machines so they run smooth and to make products such as plastic. There will be so much oil left over once we have fusion that nobody will fight over it. It will become very low in cost since there will not be that much use for it.

The poverty and starvation around the world is wrong. It makes us all sad to see the ads on TV or the signs that ask us to give money to help those less fortunate people. There are wonderful people around the world who spend their lives helping to feed the hungry. They feel the suffering of others and work to bring them food. The problem is this job is getting harder and harder. The deserts around the world are growing larger. The pollution from burning coal and oil and the wars for oil are harming everyone.

So along with those who are trying to bring food to the hungry, there is another group of people who are working to help end hunger around the world in a way that will last for a very long time. It is a way to feed the hungry where everyone will be able to take care of themselves and raise their own food. These people are working to bring fusion to the world. Two of these people are my friends, Pat Boone and Tomer Tamarkin.



Pat Boone



Tomer Tamarkin

The picture on the next page shows what they hope to bring to the world. With fusion, most of the wonderful people and organizations that are working to ship food to the hungry will be able to stop. They will be able to close down some of these charitable organizations because the people around the world will have the energy to bring fresh water to their farms and to heat greenhouses so they can grow their own food.



Feeding the hungry would be a dream come true for everyone. If fusion helped to do this it would be worth all the work it takes to make it happen. But this is not the end to the fusion story. As we all know, people need food, but there is something else we all need; we need to dream.

Since the beginning of humanity we have been dreamers. We have climbed every mountain, crossed every ocean and built all the things our minds could dream. People used to have to walk wherever they wanted to go. Then they tamed animals and were able to ride horses so they could travel further and faster; exploring new parts of the world. Over the past two hundred years these dreams have grown so fast as we developed trains, cars, powered ships and then airplanes and jets; even rockets to begin letting us explore space. The problem is this takes a lot of energy. Our energy is running out and our dreams will have to be forgotten. What good is a car without energy to make it go? It just sits there in the garage. Right now there is not even enough energy for all the world to have the same dreams we have in America. If everyone had a car there would not be enough gas for everyone.

Fusion is unlimited energy and it will let us have unlimited dreams for everyone around the world. We can explore space in ways we have never done before. The picture on the next page may never happen, but its only chance to have this fun dream come true is with fusion

Unlimited Energy Unlimited Dreams



THE ENERGY OF THE LIGHT OF CREATION

We have been given a dream and a hope for the future, but there are many people who like the way things are now. Many people don't even know about fusion and don't understand the amazing and wonderful things it will do for us all. There are people who scare us with stories about global warming and pollution. They are afraid of the future, but we can go into the future without fear if we just take this great gift of fusion.

We can feed the hungry, power our dreams and go into the future without fear, if only we will. You are young, but you can still help spread the story of fusion. Tell your friends about this book and share it online at www.fusion4freedom.com. Most of all, don't listen to those who want to fill you with fear, but instead, tell them of your dreams.

In the next part of this book we will tell you a little more about fusion and how it works. Don't worry if you only understand a little about what we are teaching here. Take what you do understand and tell people. In time you will begin to understand a lot more.

What is FUSION?

(You may already know some of this, so feel free to look around and jump in wherever you like.)



Electron



Proton



Neutron

Understanding fusion is simple. There are just three basic building blocks for all atoms.



The electrons have a
negative electric charge.



The protons have a
positive electric charge.

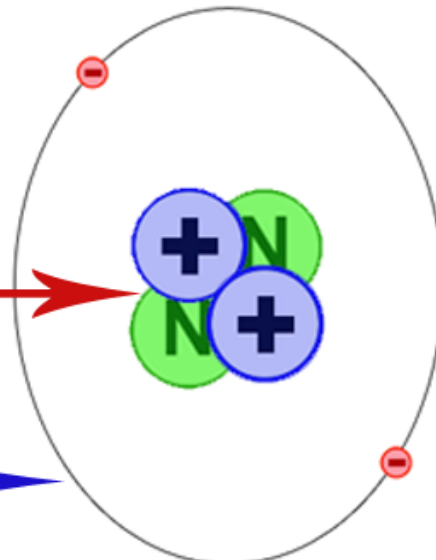


The neutrons do not have
an electric charge;
they are neutral.

The protons and neutrons are
found in the center of the atom.

This area in the center is called
the nucleus of the atom.

The electrons are found in the
space around the nucleus.



Helium

How Protons and Electrons Behave



When there are two protons or two electrons near each other, both electrical charges are the same. When two things have the same electrical charge they always push away from each other. **LIKE CHARGES REPEL**



It's just like the poles of a magnet, when the same poles point toward each other, they push apart.

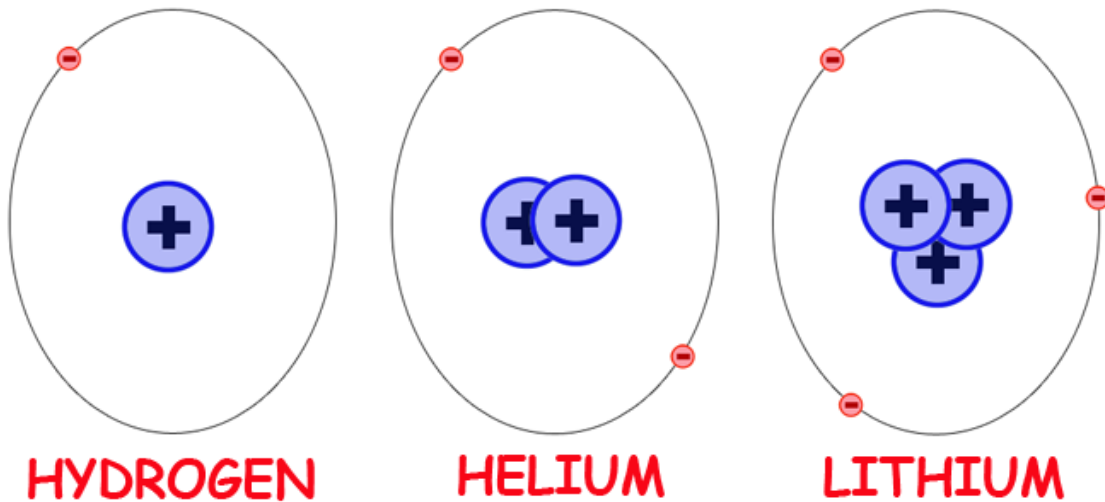


A positive and a negative charge attract just like the North and South poles of a magnet.



Neutrons don't have an electric charge, so they don't get involved in this struggle; they stay neutral.

Protons, Electrons and Neutrons Make Up Atoms.



Protons make up the center of the atoms.

The number of protons fused together in the center of the atom tell us what kind of atom it is. 1 proton makes it a hydrogen atom, 2 makes it a helium atom and 3 makes it a lithium atom... all the way to uranium at 92.

Electrons are attracted to the positive charge of the protons.
Each electron balances the charge of one proton.

You may be saying,

“WAIT A MINUTE, YOU SAID THAT PROTONS REPEL EACH OTHER! THEN HOW ARE THEY SITTING THERE TOGETHER IN THE CENTER OF THE ATOMS?”

We were really hoping that you wouldn't notice;
now we have to do another illustration.

What is holding the protons together?

Before we go into protons sticking together instead of scattering like everyone knows they should, we should take a quick look into forces.



**THE
ELECTRIC
FORCE**



**THE
MAGNETIC
FORCE**



GRAVITY

We are all familiar with three of the forces that shape our world. We have all seen static electricity at work, even if it was just sticking a balloon to a wall. We have all played with magnets. And, of course, gravity is pretty reliable. I mean, when was the last time you woke up in space because you forgot to pay your gravity bill?

But there is something about these forces you may have never thought about.

How far can they reach?



**Gravity has long, weaker arms.
Magnetism has short, stronger arms.**



Gravity can reach from the Earth to the Moon.

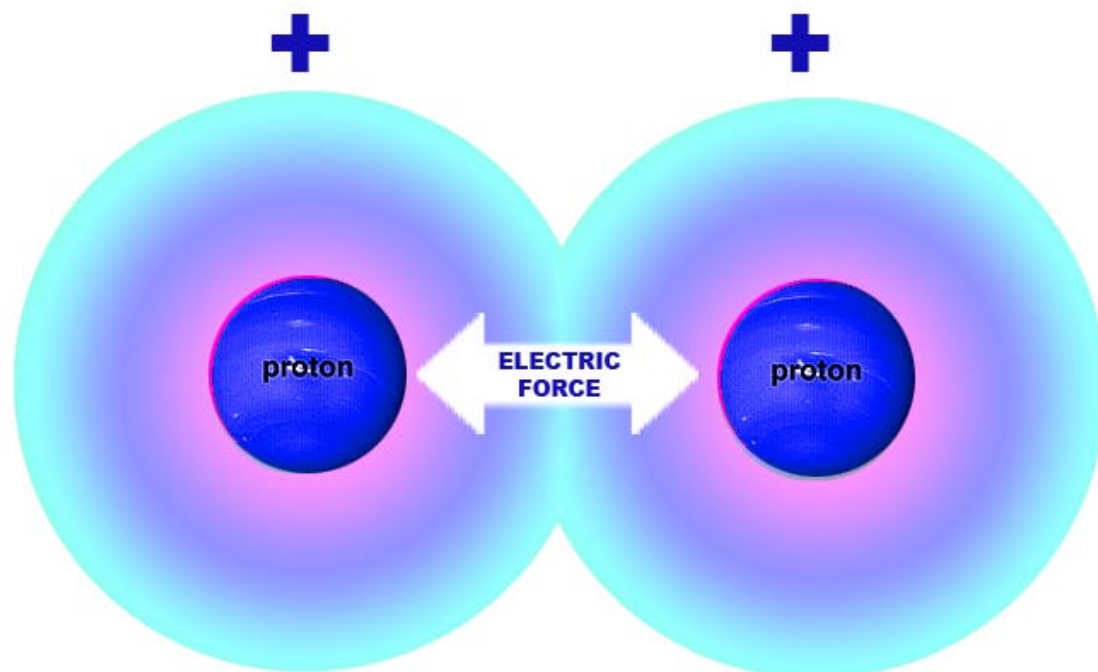
A Magnet can pick up a car and lift it against Earth's gravity.

The magnet wins this tug-of-war when the car is close; but just a few feet away the magnet can't pick up anything.



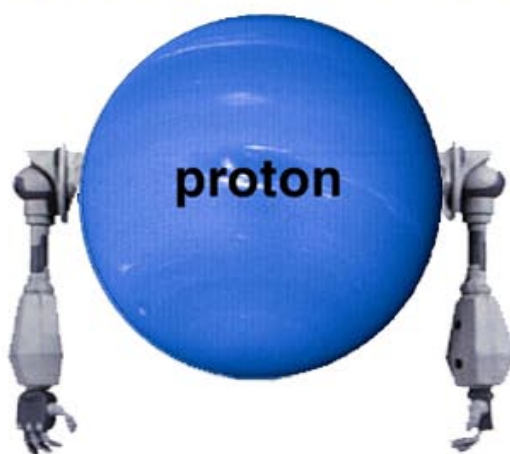
The protons both have a positive electric field around them that makes them move apart.

LIKE ELECTRIC CHARGES REPEL.



But there is another force

THE STRONG FORCE

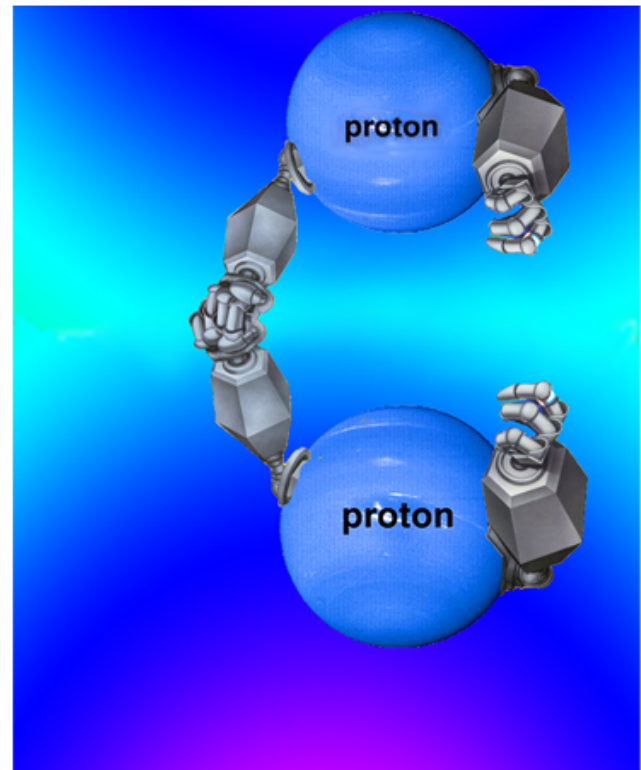


**The STRONG FORCE
has very short arms, but they are very strong.**

If protons go very fast, when they crash into each other they push right through the electric field that holds them apart. If they are going super fast, they get so close they can grab onto each other with the strong force.

The electric force still tries to push them apart, but the strong force is so strong it keeps holding them together.

Sure the strong force has stubby little arms, but it keeps the whole universe from blowing up like a giant bomb.



So that's the story of protons, neutrons and electrons.
These three little particles make up every kind of atom.
Then all the different kinds of atoms join together in all sorts of ways to make up everything you see around you.

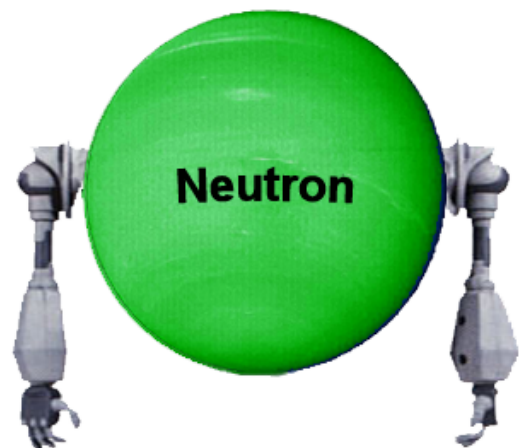
What's that you say, "I didn't tell you much about neutrons?"

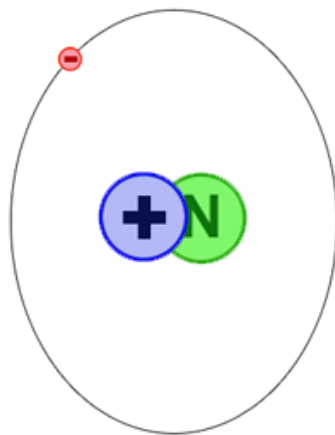
Well, we can't go too far in understanding fusion and fission without knowing about neutrons.

The neutron doesn't have an electric charge of positive or negative, so it doesn't really get involved with the big electric force tug-of-war going on in the universe.

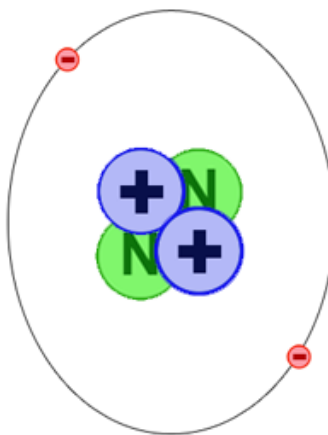
The neutron stays neutral, but it does have the strong force, just like the proton. This is very important.

The strong force allows the neutron to join with protons in the center of the atom.





Hydrogen



Helium

Neutrons join with protons in the center of the atom.

Since the neutrons don't have an electric charge they don't change the atom very much.

In the drawing above you can see a hydrogen atom with one neutron. Hydrogen is hydrogen because it has one proton. The number of neutrons it has doesn't change it from being hydrogen.

Each kind of atom will have some atoms with one number of neutrons and other atoms will have a different number of neutrons. For example; some hydrogen atoms have two neutrons and a very few even have three. Most hydrogen atoms don't have any neutrons.



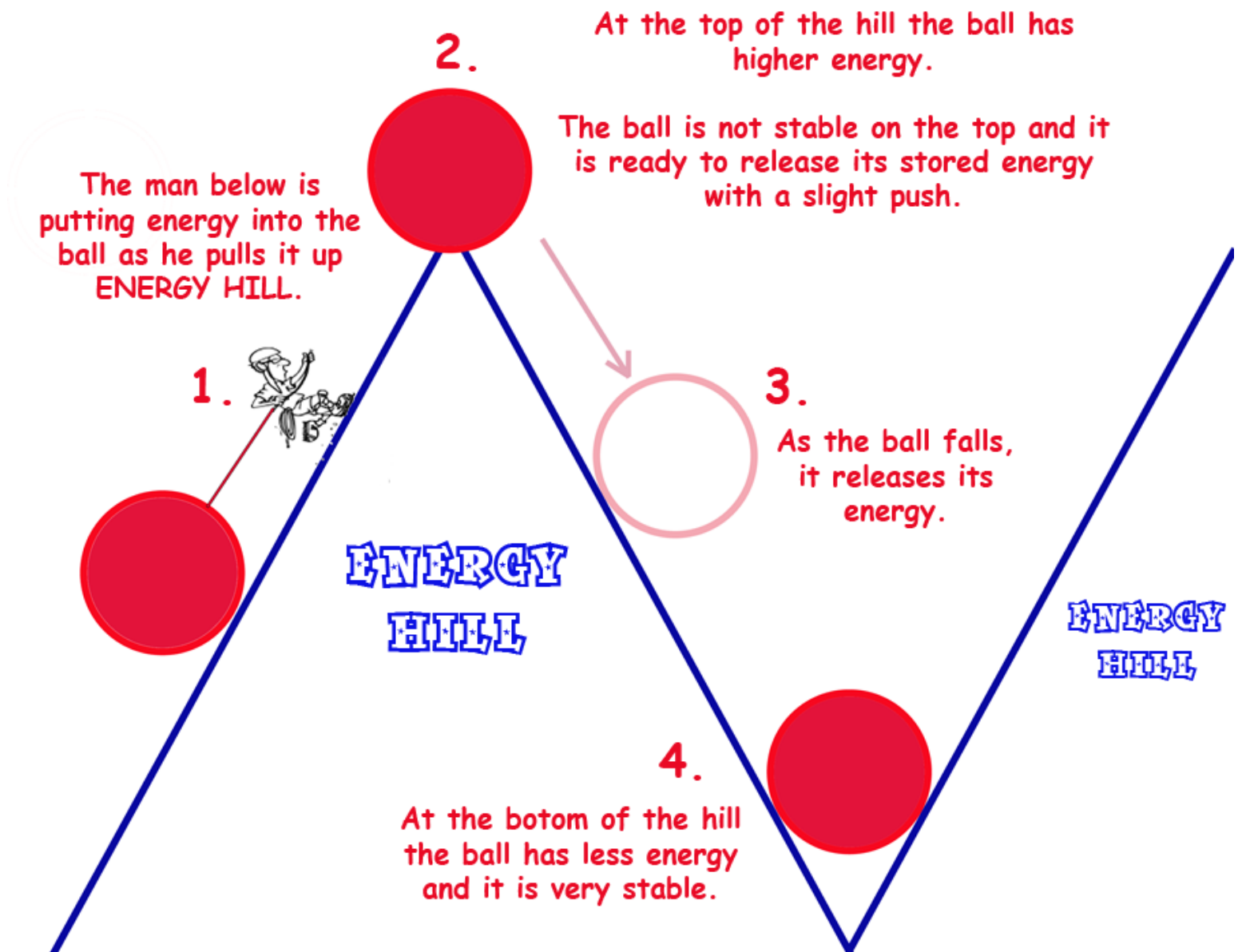
Another example is helium, it always has two protons. But if you have a balloon filled with helium, some of the helium atoms in the balloon will have only one neutron and others may have three. Most helium atoms will have two neutrons.

This is one case where it would be better to have more helium atoms with only one neutron because they are lighter and your balloon would fly a little better.

ENERGY

Energy is what moves things. If you pick up a ball and hold it over your head, you are storing energy in the ball. When you drop the ball, the energy that you put in when you lifted it up is now released and the ball falls faster and faster to the ground.

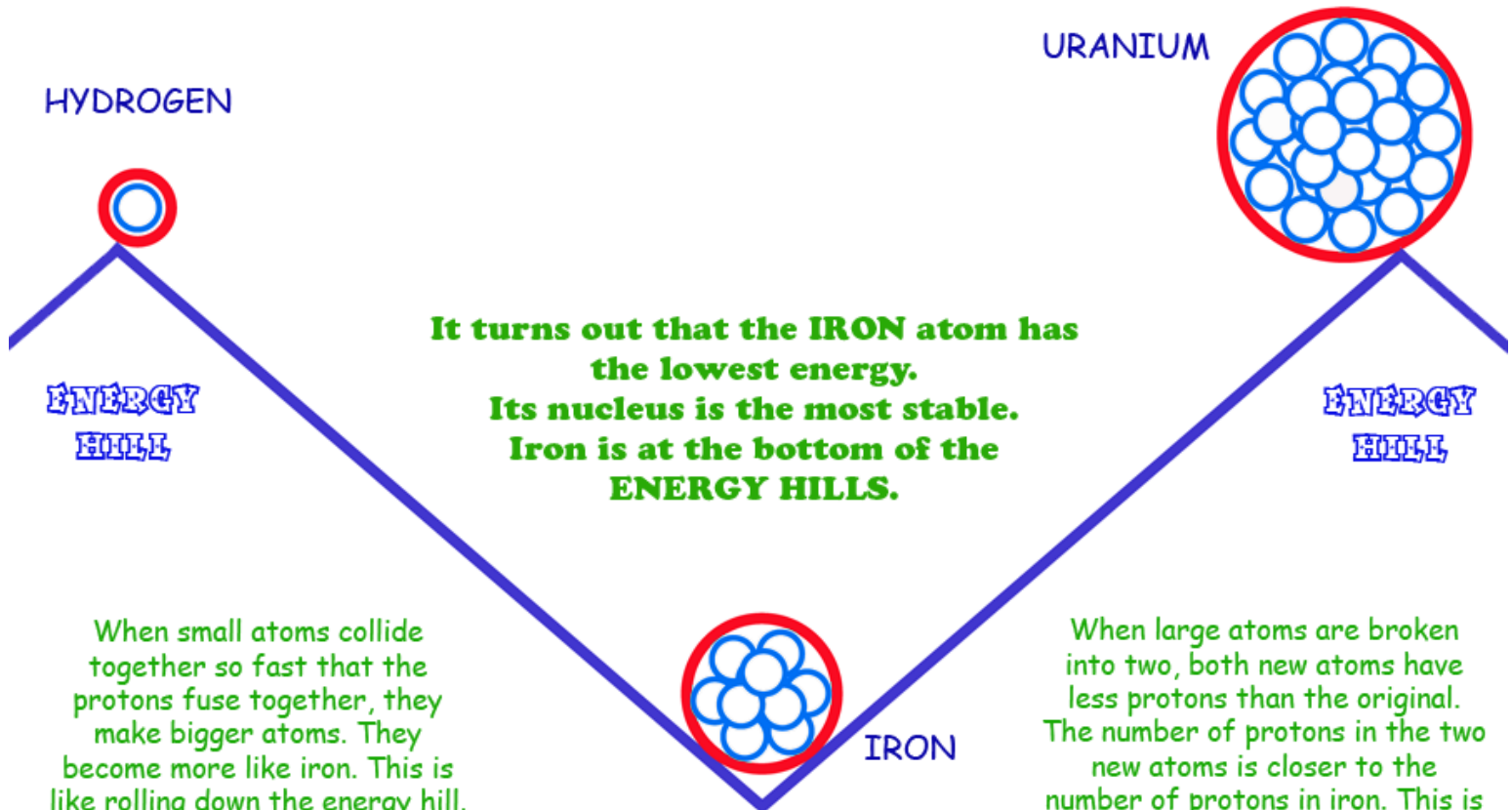
The same thing happens when you stretch a rubber band. When you let go of the rubber band, it shoots away using the energy you stored in it when you pulled it back.



The center of the atom is called a nucleus. Just like the stretched rubber band or the ball lifted up high, each nucleus has energy stored inside from all of the protons and neutrons stuck together.

Think about the energy in the atom's nucleus. What would happen if the strong force suddenly stopped working? All of the protons are charged positive and they would instantly shoot apart from each other.

It would release the stored up energy of each proton as the strong force let go and the atoms would explode.



When small atoms collide together so fast that the protons fuse together, they make bigger atoms. They become more like iron. This is like rolling down the energy hill. This is called fusion and it releases energy.

When large atoms are broken into two, both new atoms have less protons than the original. The number of protons in the two new atoms is closer to the number of protons in iron. This is the way atoms larger than iron roll down the energy hill. This is called fission and it releases energy.

The hydrogen atom is too small and the uranium atom is too big. But the iron atom is just right!

Hey! Is he making fun of me?



Image from
www.rjohnwright.com

Fission is where we take big atoms, such as uranium and break apart the nucleus so that it becomes two smaller atoms. The smaller atoms are closer to being like the iron atom, so this releases a lot of the atom's stored up energy.

A fast moving neutron strikes the nucleus of a uranium atom and splits it into two new smaller atoms.

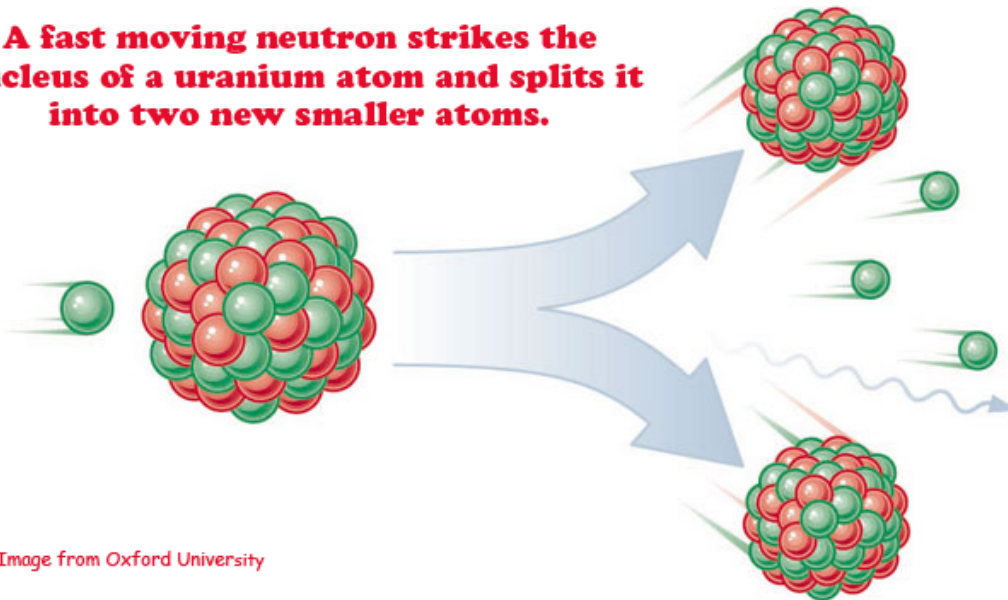


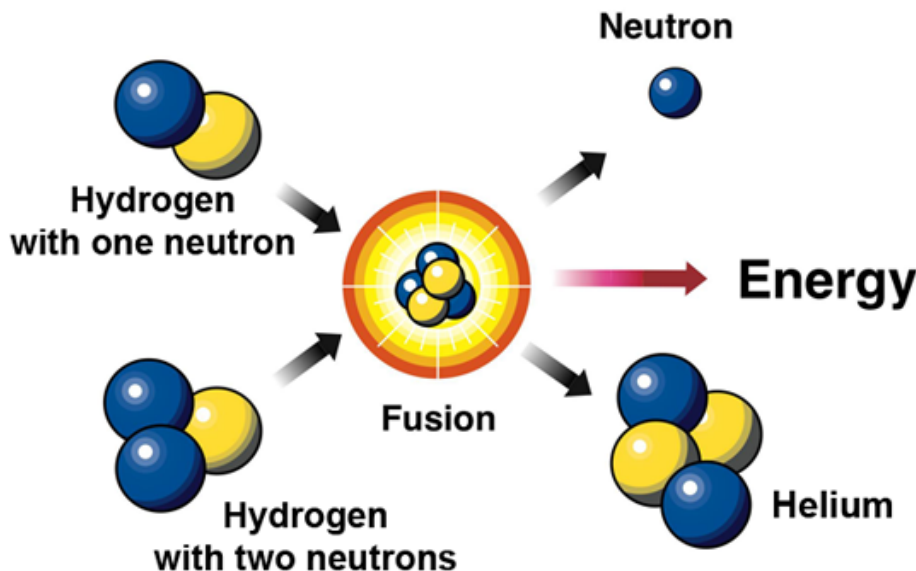
Image from Oxford University

When the two new atoms split off, they release more fast moving neutrons.

These fast moving neutrons then hit other uranium atoms and split them. These also release more neutrons.

This is called a chain reaction. Fission nuclear power plants use this chain reaction to get energy.

Fusion is where we take small atoms, such as hydrogen and collide them together so fast that the protons fuse together to make larger atoms. These new atoms have more protons so they are a little closer to the low energy iron atom. This releases energy.



Fusion happens when a hydrogen atom with one neutron crashes into a hydrogen atom with two neutrons at a high enough speed.

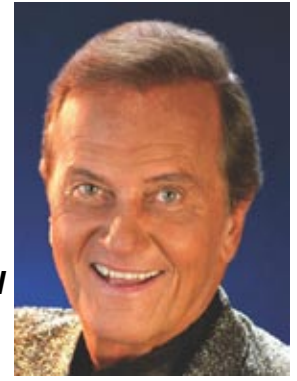
They hydrogen atoms fuse together making one helium atom and releasing an extra neutron.

This releases energy. Scientists are trying to use this energy to make power plants that will bring unlimited energy to the world.

Thanks for taking time to learn about fusion. We hope that you want to help spread this dream to others. If you do want to help, the best place to start is with your family. The next part of this book is for the adults in your family. It is an article by Pat Boone. There are also more articles by Pat Boone and Tomer Tamarkin at our Web site at www.fusion4freedom.com. You can show this Web site to your friends and family.

Together we can bring the dream of fusion to the world.

Pat Boone is a legendary Hollywood icon in the performing arts who traces his ancestry to the American pioneer, Daniel Boone. Pat has sold over 45 million albums, had 38 top 40 hits, and starred in more than 12 Hollywood motion pictures. Pat graduated from Columbia University in New York City, magna cum laude in 1958. Pat is well-known for his old-fashioned values, which contributed to his fame and popularity in the early days of the rock & roll era to the present. Today he is still active on television and in the motivational speaking circuit. Pat has spent the last few years writing columns and books and runs his own record label named Lion & Lamb. Pat's first book, "Twixt Twelve and Twenty," Prentice Hall, was a number 1 Best Seller in America. Pat lives with his wife of 59 years,



Pat Boone

There Is Hope for the World

I knew a man named John Lennon.

I first met him with his buddies, Paul, George and Ringo, in Las Vegas when they were just fresh, funny and talented young kids from Liverpool.

I and my daughters visited with them backstage between their two shows in the Thomas Mack Arena and found them charming and energetic, relishing their new and sudden stardom.

Like the rest of the world, I watched as their careers blossomed and assumed fantastic proportion. Each record, and then each movie, eclipsed the last ... until they had become the greatest singing group in music history. It will never be equaled.

Many years later, I visited with John and producer Phil Spector in a nice health-food restaurant while they were working on a new album. As we compared notes and stories about our experiences, I asked John what he thought was the main reason for the Beatles' incredible success. He thought a minute behind his little round glasses and answered, "Imagination."

Imagination. As Ted Kennedy quoted his brother, Robert: "He thought of things that never were, and asked 'why not?'" And young Walt Disney – at a time when the "cartoons" he and a couple others were successfully producing cost an average of \$5,000 – told his incredulous brother, Roy, he envisioned a full-length feature film, in total animation, and estimated it would cost \$1.5 million! It seemed unthinkable. But it was imaginable, and it became a worldwide sensation: "Snow White and the Seven Dwarfs," a timeless classic. Imagination. It's much more powerful than most realize. In fact, hardly anything of value has ever been accomplished without beginning as an idea, which is really imagination. In Genesis 11, a group of mere humans imagined a city and a tower reaching into heaven, and they began to actually build it. The Lord God said, "Indeed the people are one and they all have one language, and this is what they begin to do; now nothing that they propose to do will be withheld from them."

"Come, let us go down and there confuse their language, that they may not understand one another's speech." And the Tower of Babel came to a halt. But now the language barrier has been erased and, as Walt Disney said, "If you can dream it, you can do it." Man can do virtually anything he can imagine.

That's why I have written five of my recent columns here on nuclear fusion. I'm not a scientist, as I said at the outset, but I have a wonderful imagination. And so do a great number of scientists who have not only envisioned a world empowered by an inexhaustible, eternally available energy source, but have come very close to making it available to humanity.

Guided by physicists and other scientists who've been personally involved at various levels, I've given a sketchy but detailed history of the early experiments and the discoveries that proved the theories of nuclear fusion; described the work and research in a number of American universities, and the funding allocated by our government during the Carter & Reagan administrations, that led to amazing breakthroughs; and I've

cited the miraculous, almost inconceivable heat levels achieved at Princeton that ached to be used in creating the plasma that would create nuclear fusion as the ultimate energy source.

But I've also detailed the unexpected resistance to this amazing progress in various departments of our own government, including the Department of Energy! Who, and why? It shouldn't be a surprise that various vested interests, powerful lobbying interests who wanted oil and gas and coal and electricity and, yes, even nuclear fission to be utilized first, prevailed.

So the funding, and much of the almost triumphant technology, dwindled and ground nearly to a halt. But we can still imagine, and the goal still can be attained. I want you to imagine with me. Imagine a world where oil is mainly a lubricant and a base for manufactured products, a world where there is plenty of clean, fresh water for drinking, irrigation and sanitation. We already have the technology and tools to desalinate and purify water for every community in the world – but we don't have the energy source or funding for it.

Fusion can do it.

Imagine a world where food doesn't have to be scarce anywhere and hunger can vanish. With petroleum no longer needed to power cars, the price of oil would plummet. We use oil to make plastics, and clear plastics make greenhouses. Inexpensive greenhouses can be manufactured, warmed and lighted by the endless supply of energy from fusion – and food can be grown anywhere. Can you imagine it?

"Global warming" can be a non-issue when fusion gives us a world where humanity leaves only a small carbon footprint. All the natural sources of energy are frighteningly finite, but fusion is infinite.

The physicists with whom I've consulted are certain that if we make a very focused, concerted and adequately funded effort, bringing fusion to the world is 100 percent certain. There are others who are more pessimistic and say there may only be a 20 percent chance, at least in the foreseeable future.

But ask yourself: If your family was on the verge of starving and you had evidence that there was a 20 percent chance that unlimited food was just over the next hill, what would you do? Wouldn't you look at your hungry children and start climbing? You'd climb a mountain, if you had to. This isn't a pipe dream. There is unlimited food and water, unlimited energy and unlimited opportunity for the human race – just over the next hill.

We've got to use our imaginations, millions and millions of us. We've got to involve our government through our elected We've got to use our imaginations, millions and millions of us. We've got to involve our government through our elected representatives, all the way to the president. We've got to use the energy we have and vote for the future just over the hill. Please visit the Fusion 4 Freedom website. <http://www.fusion4freedom.com>

In the months just ahead, scientists will be meeting, organizing, holding workshops with top fusion and plasma leaders, military strategic planners in the model of Admiral Hyman Rickover, who led the development of the nuclear submarine, and major philanthropists. The goal? A clear plan leading to the demonstration of a working fusion test reactor by the end of this decade. This year is the 50th anniversary of John Kennedy's challenge to America to put a man on the moon and bring him safely home to earth.

We did it then. And we can do it now – if we harness the skills and brilliance of American and Israeli scientists. I imagine we can!

Join with us at www.fusion4freedom.com



Steve Cooper is the founder of Diamond Bar Productions. They are now producing their first Web based video series, The Epic Tale of Wyatt C. Mollusk. This is a new method for teaching science within an adventure show. The show has a large cast of strange outer space characters, but also features young Pat Boone and Tomer Tamarkin as they work to bring fusion to the galaxy. Steve met Tomer at a political rally and along with Pat, now helps to make the promise of fusion understandable to the world.

www.diamondbarproductions.com

Steve is also the author of *Paradigms for Pinocchio* and *The Christian Guide to Dragon Slaying*. He lives with his wife, Liz, on their ranch in the Sierra foothills where they raised their four children.