/r/videos

reddit.com/r/videos/comments/22jaiv/nuclear_fusion_in_five_minutes_iter/?sor...

Search

LOG IN SIGN UP

584 Nuclear Fusion in five minutes (IT... CLOSE

Posted by u/LxSwiss 6 years ago

584

Nuclear Fusion in five minutes (ITER)

m.youtube.com/watch?...

87 Comments Share Save Hide Report 91% Upvoted

This thread is archived

New comments cannot be posted and votes cannot be cast

SORT BY Old

Comment deleted by user 6 years ago 4 children

chordnine 29 points · 6 years ago

I was under the impression that a fusion reaction producing more energy than was put in was still a long ways away, and that a 1:1 ratio had not even been accomplished. Under this plan, they are saying that they can achieve a 1:10 energy ratio. Am I missing something?

Powerfury 36 points · 6 years ago

They said it was a 1:10 ratio, but only for 300 second (5 minutes). So it does not seem sustainable for extended periods of time. This plant sounds more of a research plant for future progress.

DiogenesHoSinopeus 45 points · 6 years ago · *edited 6 years ago*

Wait what? We've actually done it with net gain and for 3 minutes? O_o

Holy fuck. I literally didn't believe we could do even that even in my whole lifetime...things will get interesting if they get it to work flawlessly.

An unlimited pollution free energy source with the second highest energy to mass ratio of all the particle reactions in physics. That is Star Trek level sci-fi technology to me. Mastering the power source of stars...an unbelievable, unimaginable achievement from a species that has practically barely even existed yet.

Everything humans seem to be imagining and believe to be impossible are slowly made into reality one way or another...it's as if we see the world around us and think it is too limiting so we start messing around with reality itself, toying with its rules and trying to break them seeing how far we can get. Maybe in the end, there's nothing we can't do anymore and we become the Gods we worship today.

Or maybe I'm just a bit too high at the moment to be on Reddit :)

[deleted] 14 points · 6 years ago

dont get too hyped. nothing's happened yet and probably wont for at least 10 years. were closer to landing on mars than getting fusion to work permanently

punchybuggyred 29 points · 6 years ago

Landing on Mars isn't really a matter of technology, we just don't have the will to spend the money on it.

zZGDOGZz 2 points · 6 years ago

Didn't we get on the moon with computers less advanced than our phones? I find that fact absolutely insane.

Guysmiley777 18 points · 6 years ago · *edited 6 years ago*

Computers don't generate thrust or oxygen, they add numbers together really fast. Most space travel limitations are engineering problems and the math can be done on paper or with a slide rule. You can't add your way out of needing to burn fuel.

zZGDOGZz 8 points · 6 years ago

Well damn, I just got knowledge bombed.

woodbr30043 3 points · 6 years ago

One of the course corrections on Apollo 13 mission was done without any navigation computers. Lovell piloted the LEM manually and used the sun and the earth in the windows as reference points. Flying to the moon and back can be done without computers, it's just a lot easier with them.

Edit : fixing autocorrect

Comment deleted by user 6 years ago 1 child

[deleted] 5 points · 6 years ago

We've been 10 years away from landing on mars since the 70s

We've been 10 years away from landing on mars since the 70s

carbonfiberx 3 points · 6 years ago

There's a joke that stable fusion power generation is persistently "50 years away."

Republicrats 2 points · 6 years ago

You should visit r/Futurology

SirGoodden 2 points · 6 years ago

Now you've got me pumped. wait...do you work for ITER?

But seriously this stuff is awesome

fuzzyshorts 2 points · 6 years ago

I'm hyped like you man! Hesitant but hyped. I went back to find this video of Dr.Michio Kaku speaking about humans and our civilization in "galactic evolution" (something like that.) Fusion energy (when and if) could take us into the playing field of possible alien civilizations. It could be the signal to the galaxy that "we're all growed up" and ready to come to the dance! Buddy, check this video and get back to me if it doesn't put a frame on the tokamak and everything going on right now.
https://www.youtube.com/watch?v=6ftF8sXzoWk&index=225&list=FLtmagBuCXGZ2hlNBskEVX8w

HybridM 0 points · 6 years ago

Hey man I'm smacked too it was beautiful.

ToxinFoxen 2 points · 6 years ago

One day, we'll be building planets.

xXChickenInTheMudXx 1 point · 6 years ago

> Maybe in the end, there's nothing we can't do anymore and we become the Gods we worship today.

Fuck, dude.

nhillson 3 points · 6 years ago

Most recent news about fusion research is about inertial confinement fusion, which is still very far from being able to break even. ITER, in contrast, uses magnetic confinement fusion, which has produced at least a 70% return on input energy, and possibly a 125% return. It's now just a matter of scaling up, which increases the power produced, as well as the efficiency.

hoagie612 1 point · 6 years ago

I think you are referring to point fusion which is underway in Berkley. They use lasers to focus energy and pressure on a single pellet of deuterium and tritium to cause fusion. They are also making progress but both of these are still decades away from replacing current fission reactors

dmacpher 1 point · 6 years ago

A net positive reaction has been achieved - http://www.bbc.com/news/science-

dmacpher 1 point · 6 years ago

A net positive reaction has been achieved - http://www.bbc.com/news/science-environment-24429621

Vetinarius 42 points · 6 years ago · *edited 6 years ago*

Since it doesn't come out clearly in the video: This will be a test reactor/powerplant, IF the 50MW to 500MW conversion is achieveable, they want to somehow achieve the same with like 50GW to 500GW, if thats also successfull, then they'll probably build a real fusion powerplant.

So no we dont get fusion power in the next 20 years... if this is successfull, we may get it in 40 years.

edit: ITER = International Thermonuclear Experimental Reactor

Neoshade 30 points · 6 years ago

It's not an advertisement. Billions of dollars have already been spent. Construction is underway in each country.
And yes, profitability is a long way off. ITER is meant to prove that net gain fusion can be done. They intend to produce energy for a matter of seconds, and to use this machine as a proof of concept and to learn more about how to do it right next time. Many smaller machines have been built to study fusion. This will be the largest ever and the first to achieve a net gain in energy.

Vetinarius 3 points · 6 years ago

Yeah i edited my comment quite heavily after i read something about ITER. From the video i thought they wanted to build a fully functionable powerplant, not a test reactor.

It seems much more realistic now. Lets all hope it will work out, if this project fails it will be hard to finance another one.

Comment deleted by user 6 years ago 1 child

Saerain 1 point · 6 years ago

I don't know, this is supposedly taking only six years to assemble and test, and many things are happening in materials science that could accelerate further projects. Even if they don't, if you're considering "getting fusion" to be the first plant to provide for the grid, I'm not sure I'd go so far as 40.

Then again, I may be underestimating at my peril how much the general populace will fight anything "nuclear".

strik3r2k8 1 point · 6 years ago

I dont even want to think about it. 20 years..*sigh..

[deleted] 3 points · 6 years ago

Does anyone know the ceiling for how much more energy fusion produces vs. fission?

Aganomnom 3 points · 6 years ago

Aganomnom 3 points · 6 years ago

Here you go

kage_25 2 points · 6 years ago

this article explains it and this picture demonstrates that fusion can produce a LOT more energy than fision

autowikibot 2 points · 6 years ago

Nuclear binding energy:

> **Nuclear binding energy** is the energy required to split a nucleus of an atom into its component parts. The component parts are neutrons and protons, which are collectively called nucleons. The binding energy of nuclei is always a positive number, since all nuclei require net energy to separate them into individual protons and neutrons. Thus, the mass of an atom's nucleus is always less than the sum of the individual masses of the constituent protons and neutrons when separated. This notable difference is a measure of the nuclear binding energy, which is a result of forces that hold the nucleus together. Because these forces result in the removal of energy when the nucleus is formed, and this energy has mass, mass is removed from the total mass of the original particles, and the mass is missing in the resulting nucleus. This missing mass is known as the mass defect, and represents the energy released when the nucleus is formed.
>
> ====
>
> **Image** [i]

Interesting: Nuclear ^power | Binding ^energy | Nuclear ^technology | Nuclear ^fission

Parent commenter can toggle ^NSFW or ^delete. Will also delete on comment score of -1 or less. | FAQs | ^Mods | Magic ^Words

BluSpecter 1 point · 6 years ago

This video makes me feel better.....

dappertgunn 3 points · 6 years ago · *edited 6 years ago*

I dont really believe in ITER.

This guy has a good talk on other ways to do fusion.

EDIT: Also really good

lewicki 3 points · 6 years ago · *edited 6 years ago*

I like this one too: Should Google Go Nuclear?

Have you seen this?

AjBlue7 9 points · 6 years ago

I read an article about this years ago when it was first announced to begin work.

The cool thing about it is that efficiency is multiplied the larger the reactor scale.

This technology is really cutting edge, the heat released from fusion reactors is as hot as the sun. Due to this problem, for a long time we didn't know how we could possibly contain so much heat, without it melting the enclosure.

Their solution was to have the plasma float around in a vacuum donut, so it doesn't touch anything. Then in order to catch the energy the receptors need to be water cooled. With this machine it is expected that they will be able to get out more energy than they put in. As we ramp up scale we will soon be close to powering cities with unlimited energy, then in the very distant future, after the process is improved, I suspect we will be able to shrink down the size of the reactors.

Its safe to say we will be able to power space ships with this technology soon.

One thing people forget when they are talking about space is that ships probably aren't going to be in the shape of a long cylinder.

One of the biggest problems with space travel is that we need artificial gravity, and it is looking like the best option is to use centrifugal force. So I Imagine space ships might look more like a donut similar to elysium.

I don't think aerodynamics would matter on a space ship since space is a vacuum, so there would be no resistances to worry about.

dalonelybaptist 22 points · 6 years ago

You kinda went a little off topic there chief

thatawesomedude 5 points · 6 years ago

Yeah. I imagine he was going to connect his two thoughts with the whole donut shape thing.

HighKingForthwind 1 point · 6 years ago

You forgot to mention the powerful electromagnets cooled to 0 kelvin used in order to contain the reaction

fuzzyshorts 3 points · 6 years ago

I getcha bro. Fusion opens up many, many doors. If this works, it could be the first real step forward for man in the 21st century. It could mean the end of the petrodollar, the end of kowtowing to saudi oil, the end of a lot of corruption and poisoning of the planet due to fossil fuel. Unlimited energy with the driving force being nations NOT corporations. Some real Star Trek federation shit!!!! If we go to space, I think the signature of a fusion reactor will be like a beacon to the civilizations of the galaxy saying "We're here! We're legal! Let's party!" https://www.youtube.com/watch?v=6ftF8sXzoWk&index=225&list=FLtmagBuCXGZ2hlNBskEVX8w

(I hope we don't fuck this up and blow up the planet before it happens.)

(I hope we don't fuck this up and blow up the planet before it happens.)

[deleted] -10 points · 6 years ago 2 children

MobyDank 5 points · 6 years ago

someone explain to me why this isn't going to work

[deleted] 13 points · 6 years ago

I'm sorry Dave, I'm afraid I can't do that.

frud 2 points · 6 years ago

It might actually work, but even if it does it will only work for 300 seconds. It's really just a $13 billion science project.

I'd rather they spent 12.9 billion on this and 100 million on LFTR tech.

landaaan 6 points · 6 years ago

High energy neutrons are nasty fuckers, they irradiate and damage any material they hit, causing fission in materials that would be stable under normal conditions. There are only a handful of elements that can sustain neutron bombardment without becoming radioactive themselves. We are currently working on developing alloys that only contain these elements and that will be resistant to the effects of neutron bombardment over a long period of time. Issues such as creep and diffusion are a big worry as a result of spallation; the material may become weak or brittle over time depending on how it behaves in that environment.

What makes this an even more challenging problem is that there doesn't exist a machine that can generate high energy neutrons similar to that of a fusion reaction, so we have to make do testing materials with low energy neutrons where only the top millimeter or so of material is effected, then studying this tiny bit of material and trying to estimate would the effect would be on bulk material. Building a high energy neutron generator has been proposed, but it will be really really expensive. Like, really expensive.

Moongrazer 1 point · 6 years ago

Thanks for the write up

brekus 1 point · 6 years ago

It's a rather long project. As I understand it there are still some unsolved problems. Entirely new materials have to be researched and produced, materials which will to be able to withstand the forces involved. A significant branch of the project is tackling these material science problems while construction continues.

I expect as long as the project isn't cancelled it will succeed in it's stated goals, whether fusion power will ever be economically viable in the next couple hundred years is an entirely different matter.

lappy960 1 point · 6 years ago

lappy960 1 point · 6 years ago

In the video it discussed that super highly heated particles were needed to achieve fusion. How safe is something like this? Could particles at 150,000,000 degrees celsius being released into the atmosphere or escaping into the facility present significant issues?

killzon32 2 points · 6 years ago

I don't think a fusion reactor would even explode... It would just fail and shutdown since the particles are energetic due to magnetic fields they would just bounce off the containment until they cool down.

And if it melted the containment then it's not like its radioactive nor would it explode.

hellothere667 2 points · 6 years ago

Nuclear engineer here. The other comments are close, but not quite on the mark. Basically, there is absolutely no risk of these energetic or "hot" particles causing any issues with the surrounding environment. Even if the containment magically disappeared during operation, the actual amount of heat would dissipate into the environment rather quickly. The fusion devices as they are today don't even pose the risk of a small "conventional" explosion. An everyday object to consider is the fluorescent light. Touch one when its on and its not burning hot. Yet the gas particles (or plasma) inside is at around 10,000 celsius. Though this is not at all near the scale of a fusion reactor, it does bring in perspective what temperature means to gas/plasma systems. While considered hot, there's just not enough particles in the system to actually heat everything else around it to its temperature. I hope this answers your question and please let me know if you have any other questions regarding fusion or nuclear technology.

Comment deleted by user 6 years ago 3 children

PositivePoster 3 points · 6 years ago

This submission has quality written all over it.

usmcplz -3 points · 6 years ago · *edited 6 years ago*

That's 5 and a 1/2 minutes. Ain't nobody got time for that!

Edit: On a side note, that humans are capable of such a creation blows me away and gives me hope for the future of our species.

dagonista 4 points · 6 years ago

Is it possible for any material to handle and contain 150 million degrees for any length of time?

RabidGinger 12 points · 6 years ago

Not really. But the point behind this is that the hot material is being held by superconducting magnets in a vacuum away from inner surface of the reactor.

superconducting magnets in a vacuum away from inner surface of the reactor.

landaaan 1 point · 6 years ago

Nope but it doesn't have to, the plasma is contained within a vacuum and held there by very powerful superconducting magnets. If the magnets fail and the plasma touches the walls the of the reactor the reaction will stop immediately because it would instantly lose too much energy

lifeisrhythm 4 points · 6 years ago

why can't there be so much more money and energy put behind research like this. unlimited energy would change the world, in my opinion, for the better. so much better.

Porpoise_of_Life 0 points · 6 years ago

If reddit has taught me anything, its that Fusion energy will be 20 years away forever

Saerain 1 point · 6 years ago

This is six years out, and Reddit is nine years old...

bkalen17 1 point · 6 years ago

Assuming we do achieve this, as much as I would love for there to be unlimited energy for the entire world how would this work financially? Oil companies would be rip-shit and so would other companies invested in other green energy sources. This is a conversation I'm sure we will have further down the road but these questions need to be asked.

Comment deleted by user 6 years ago 3 children

Won2treeForks5 1 point · 6 years ago

I've been waiting for this since my first physics class sophomore year of high school! I'm really excited.

Gonazar 2 points · 6 years ago

They've been working on this model for 30~40 years now and it still hasn't achieve a sustainable output greater than input.

Best guys that I think have a chance of successful sustainable fusion energy is General Fusion. Here's their wiki for a quick summary.

autowikibot 1 point · 6 years ago

General Fusion:

> **General Fusion** is a Canadian company based in Burnaby, British Columbia created for the development of fusion power based on magnetized target fusion (MTF). As of 2013 [update] they are working on a prototype system, which they hope to have working by 2015. They are also working on full-scale versions of several key subsystems. They hope to have a working reactor by

> fusion (MTF). As of 2013 [update] they are working on a prototype system, which they hope to have working by 2015. They are also working on full-scale versions of several key subsystems. They hope to have a working reactor by 2020. General Fusion is funded by private venture capital and by the Government of Canada.
>
> ====
>
> **Image** [i]

Interesting: Fusion ^power | Nuclear ^fusion | ^Polywell | DIII-D (fusion ^reactor)

Parent commenter can toggle ^NSFW or ^delete. Will also delete on comment score of -1 or less. | FAQs | ^Mods | Magic ^Words

Biotot 1 point · 6 years ago

So in the video it mentioned that they convert heat into energy. I understand that is the basic set up for most energy sources, but at the end of the day will they still be boiling water (or other liquid) to produce steam to power a turbine?

I remember being floored when I read a (drastically) over simplified explanation of a nuclear reactor "Hot rocks boil water, steam turns turbine; power."

energy_engineer 1 point · 6 years ago

> I understand that is the basic set up for most energy sources, but at the end of the day will they still be boiling water (or other liquid) to produce steam to power a turbine?

Not ITER - this is just an experiment.

DEMO (the power plant to follow ITER), however... Yes, that's the plan. Boil water to drive turbines.

ToxinFoxen 1 point · 6 years ago

Did you know Greeenpeace attacked this project?

http://www.theregister.co.uk/2008/10/22/fusion_greenpeace_no/

http://www.greenpeace.org/international/en/press/releases/ITERprojectFrance/

Greenpeace is deranged, insane, backwards and extremely dangerous. Anyone who cares about the Environment or the future of civilization should treat these deranged monkeys as pariahs.

RebelWithoutAClue 1 point · 6 years ago

Where do we get deuterium and tritium fuel? Is it centrifuge separated? Would be be producing sufficient amounts in heavy or light water reactors?

brekus 1 point · 6 years ago

Deuterium is a fairly rare isotope of hydrogen, however hydrogen is so common that it isn't hard to get significant quantities of it. Tritium on the other hand is globally scarce, to get it in usable quantities most plans involve having a lithium

that it isn't hard to get significant quantities of it. Tritium on the other hand is globally scarce, to get it in usable quantities most plans involve having a lithium "blanket" around the reactor, the neutrons bombarding the lithium will breed tritium. So once the reactor is running it can theoretically produce the rarest of its fuels from lithium.

One of the things to keep in mind also is that you only need small quantities of these things to produce a lot of energy, even compared to fission. If I'm remembering right its something like half a gram of material to sustain the reaction producing 500MW for several hundred seconds.

ProAssad 1 point · 6 years ago

Whats so hard about setting up a couple of miles of solar panels for each city...Don't get me wrong fusion is the way to go but jesus thats alot of money. What happend with the alternative to nuclear i forgot the name but it was very similair just not as dangerious & more efficient.

DoneStupid 1 point · 6 years ago

You're thinking Thorium? IIRC China are investing heavily in Thorium reactor research right now, hopefully they'll get some good working results soon-ish to tide us over until something even better comes along.

Solar panels though, they're kinda.... underwhelming when it comes to industrial power requirements.

ProAssad 1 point · 6 years ago · *edited 6 years ago*

Yep Thorium, now i remember it was supposedly safer to but not sure why where not trying that.

2Punx2Furious 1 point · 6 years ago

This reminds me of Civilizations 5.

To achieve a scientific victory, you have to build a spaceship. You can build all the parts of the ship in different cities and then move them to one city to assemble them.

[deleted] 2 points · 6 years ago

I like that this video is titled "Nuclear fusion in five minutes" which is both the time that the video roughly runs as well as the time they will attempt to create a fusion reaction for.

tesseract_rider 1 point · 6 years ago

Engineer on ITER project here. IF you want to know more the recent article in The New Yorker is probably one of the best places to start for a well reasoned, positive, but realistic assessment of the state of things. The follow-on article includes the executive summary of a recent management review which is pretty damning, but outlines how hard it is to organise a project of this scale when the initial conditions were so screwy. Still, I remain optimistic.

were so screwy. Still, I remain optimistic.

PeonSanders 1 point · 6 years ago

ITER is a very promising project, but as with any gamble like this, there are risks. In the case of the US, Fusion Energy Science drew the short straw of budget cuts, with money going to research like Biological Energy Sciences, that have a faster and more certain payoff. ITER is the only ambitious project that retained funding, meaning that US tokamaks and other research projects into this same technology are underfunded and in some cases, closing down, despite yielding interesting findings in studying plasma (there's interesting research and science on the way to fusion, like any other field). You also tend to lose generations of researchers who can't all work at ITER, and face international competition to do so.

It's an all your eggs in one basket thing, which is great, if it pans out, and not so much if it doesn't. I'm much more worried about the politics and funding side than the science. The countries have to deliver what they have pledged to deliver, at the right time, to required quality. And the cost of this investment is massive, and if one country chickens out, others will too. Some of the manufacturing for this is very very technical and incredibly expensive.

grittycotton 2 points · 6 years ago

Why the tokamak design is not economical. Here's a talk given by Dr. Robert Bussard @Google a year before he died. https://www.youtube.com/watch?v=rk6z1vP4Eo8#t=539

itrichs 1 point · 6 years ago

They are building it in Southern France and they are already talking about the finish date.... Add a few more years to the schedule.

9outof10arequestions 1 point · 6 years ago

https://www.youtube.com/watch?v=7f5d-bRgieI Nice idea copying the intro. Also, does anyone know if the polywell is solid science?