Audio file

FUGE deep dive pseudo podcast 1.wav

Transcript

00:00:00 Speaker 1

Hey everyone ready for some mind bending cosmology? You know I love getting your suggestions for deep dives and this one really caught my eye. Oh yeah, it's called Flat Uniform, Granular Expansion, FUGE for short. It sounds a little sci-fi to me.

00:00:17

Uh.

00:00:17 Speaker 2

I can see why it definitely pushes some boundaries.

00:00:20 Speaker 2

It comes from a blog post, actually. Yeah, it was published on neopolitan's philosophical blog back on March 21, 2020.

00:00:22 Speaker 1

Ohh cool.

00:00:28 Speaker 1

3 so not exactly peer reviewed science.

00:00:31 Speaker 1

But hey, that's what makes these deep dives fun, right? We get to explore some unconventional ideas.

00:00:35 Speaker 2

Exactly. And this one's got some pretty interesting concepts about how the universe works. I mean, where do we even start with something called flat uniform, granular expansion?

00:00:44 Speaker 1

Well, I figure we break it down piece by piece. Like what does it even mean for the universe to be flat? I mean, it's not like a pancake, is it?

00:00:50 Speaker 2

Haha, no, it's not about the universe being literally flat. It all comes down to the curvature of space time you can imagine.

00:00:58 Speaker 1

Oh, space time curvature. That's where things start to get a little tricky for me.

00:01:01 Speaker 2

Right. But it's actually a pretty simple idea, at least visually. Imagine like a stretched-out rubber sheet. If you put a ball on it, it curves in.

00:01:09 Speaker 2

Word.

00:01:10

Right.

00:01:11 Speaker 1

OK. Yeah, I can picture that.

00:01:12 Speaker 2

That's like positive curvature. Then you've got negative curvature like a saddle, where the centre dips down.

00:01:18 Speaker 1

OK, so positive curvature bends in negative curves out.

00:01:21 Speaker 2

Exactly a flat sheet then would have 0 curvature, no dips or curves, and that's what cosmologists think our universe has.

00:01:26

Hmm.

00:01:29 Speaker 1

On a large scale at least.

00:01:30 Speaker 2

Right the blog post.

00:01:32 Speaker 2

Without that, the universe might be flat overall, but not necessarily in every little region.

00:01:36 Speaker 1

So, like the Earth seems flat to us because we're so small compared to its curve.

00:01:41 Speaker 2

Precisely.

00:01:42

Hmm.

00:01:43 Speaker 2

And this whole flatness thing is tied to the idea of critical density.

00:01:46 Speaker 1

Critical density. Now that's a term I've heard thrown around a lot, but I'm not sure I fully grasp it.

00:01:50 Speaker 2

Think of it this way. A flat universe has just the right amount of matter and energy to perfectly counterbalance the inward pull of gravity.

00:01:59 Speaker 2

So the universe is expanding, but not so fast that it flies apart.

00:02:03 Speaker 1

And not so slow that it will collapse back in on itself. It's like that Goldilocks scenario, right?

00:02:07

Just.

00:02:07 Speaker 2

Exactly, not too much stuff, not too little. Just the perfect amount to keep things balanced. So we've got cosmic flatness down kind of.

00:02:16 Speaker 2

Sort of. But then there's the whole granular part of FUGE. That's where things get a little more well out.

00:02:23 Speaker 1

There. Yeah. That one really threw me for a loop. The blog post talks about expansion happening at the level of tiny divisions of space, which honestly sounds a bit like science fiction.

00:02:33 Speaker 1

Working to me.

00:02:34 Speaker 2

It does sound pretty wild.

00:02:35 Speaker 1

Yeah.

00:02:36 Speaker 2

But the basic idea is this.

00:02:38 Speaker 2

In the FUGE model, the universe isn't just expanding because galaxies are moving apart. Space itself is stretching.

00:02:46 Speaker 1

So it's not like galaxies are sailing through space. It's more like the space between them is being created.

00:02:51 Speaker 2

Yeah, like, imagine the universe is this giant grid and the expansion is happening because tiny squares, little grains of space are being added to that grid constantly.

00:03:00 Speaker 1

And these grains are popping up everywhere all at once.

00:03:02 Speaker 2

That's the idea. And get this, they're being added at the.

00:03:03 Speaker 1

Yeah.

00:03:05 Speaker 2

Speed of light.

00:03:06 Speaker 1

Whoa. OK, so it's not just that things are moving apart.

00:03:09 Speaker 1

It's that space itself is being woven with new threads, so to speak.

00:03:15 Speaker 2

That's a great way to put it.

00:03:16 Speaker 1

But hold on. If space is expanding everywhere, wouldn't that mean like the Earth is moving away from the sun?

00:03:22 Speaker 2

Ah, that's a smart question. And that's where gravity comes in. Even though space is expanding the Earth and the sun are held together by their gravitational attraction, think of it like 2 magnets stuck to that rubber sheet we talked.

00:03:34 Speaker 1

About. Oh, right. So even as the sheet expands, those magnets stay pretty close together.

00:03:39 Speaker 2

Exactly, gravity acts like a tether, keeping things from drifting too far apart.

00:03:44 Speaker 1

OK, that makes sense. But here's another thing that's been.

00:03:47 Speaker 1

Me. If the universe is constantly expanding, wouldn't its density decrease overtime?

00:03:53 Speaker 2

Right, you'd think so, wouldn't you?

00:03:54 Speaker 1

Because everything's getting more spread out, right? So how can it stay flat with that critical density if everything is getting less dense as the universe gets bigger?

00:04:04 Speaker 2

That's where FUGE really gets interesting.

00:04:07 Speaker 2

It proposes that to maintain that critical density, that flatness, as the universe expands, mass energy is constantly being added to the universe.

00:04:16 Speaker 1

Wait, hold on. So the universe is getting bigger and heavier at the same time.

00:04:19 Speaker 2

That's the gist of it, yeah.

00:04:21 Speaker 2

And it's pretty mind-blowing concept when you think about it.

00:04:23 Speaker 1

It definitely is, but where is all this extra mass energy coming from? That seems like a pretty big question mark.

00:04:29 Speaker 2

It is a huge question mark. Even the blog author admits it's a mystery.

00:04:33 Speaker 1

So we're talking about a universe that's expanding and gaining weight. You have no idea where the extra weight is coming from.

00:04:39 Speaker 2

Pretty much.

00:04:39

Yeah.

00:04:40 Speaker 2

But there are a couple of ideas floating around. The blog posts suggests that the amount of energy being added is actually enormous.

00:04:47 Speaker 1

Like how much are we talking?

00:04:49 Speaker 2

Well, it gets into some pretty technical terms, but think half a Planck mass per unit of Planck time.

00:04:55 Speaker 1

Half a Planck mass.

00:04:58 Speaker 1

Per Planck time.

00:05:01 Speaker 1

I'm gonna need to break that down for me.

00:05:02 Speaker 2

Right, sorry. A Planck. Mass is a super tiny unit of mass. Something like 22 micrograms. Picture a flea egg. That's about the size.

00:05:10 Speaker 1

OK. And Planck time?

00:05:11 Speaker 2

Planck time is the smallest meaningful unit of time we can measure. Incredibly brief, but the point is this mass energy isn't all concentrated in one place. It's spread out throughout the universe.

00:05:22 Speaker 1

So woven into those new grains of space that are constantly being added.

00:05:28 Speaker 2

Exactly. It's not like sudden bursts of energy appearing out of nowhere.

00:05:31 Speaker 2

It's a subtle but constant influx happening everywhere at once.

00:05:35 Speaker 1

OK, so a slow and steady energy drip, but on a cosmic scale. But we still don't know where it's coming.

00:05:41 Speaker 2

From right, but the blog post does offer a couple of possibilities. One idea is this concept of a feeding progenitor universe.

00:05:48 Speaker 1

A feeding progenitor. What does that even mean?

00:05:51 Speaker 2

Think of it like a parent universe, one that maybe collapsed or something and is now transferring its energy into our universe.

00:05:57 Speaker 2

Like a cosmic umbilical cord.

00:05:59 Speaker 1

Whoa, that is wild. What's the other possibility?

00:06:02 Speaker 2

The other idea revolves around this concept of negative energy.

00:06:05 Speaker 1

Negative energy is that even a thing?

00:06:07 Speaker 2

It's a theoretical concept, but basically the idea is that the expansion of the universe itself creates negative energy.

00:06:13 Speaker 1

OK, so the expansion is like borrowing energy from somewhere and that creates a debt of negative energy.

00:06:19 Speaker 2

Sort of, yeah.

00:06:20 Speaker 2

And that negative energy balances out the creation of positive mass energy. It keeps the universe's overall energy budget at zero.

00:06:24 Speaker 1

Hmm.

00:06:28 Speaker 1

So it's like cosmic accounting, making sure everything balances out.

00:06:32 Speaker 2

Exactly. But it's important to remember that these are just theories, very speculative ones at that.

00:06:37 Speaker 1

Right. We're definitely in the realm of we don't know for sure territory.

00:06:41 Speaker 2

Absolutely, but that's what makes cosmology so fascinating, isn't it? We're grappling with some of the biggest mysteries in the universe.

00:06:48 Speaker 1

It's definitely mind-boggling. So F huge, saying the universe is flat, expanding in this granular way, constantly gaining mass energy from who knows where. It's a lot to take in.

00:06:59 Speaker 1

But before my head explodes, I want to bring this back down to Earth for a minute. How does this model, with all its weirdness compared to the standard model of cosmology, the one we?

00:07:07 Speaker 2

Usually hear about ah, that's a great question and it's where FUGE really starts.

00:07:11 Speaker 2

To shake things up.

00:07:12

No.

00:07:12 Speaker 2

Well, FUGE actually challenges some of the core assumptions of the standard model. For example, it doesn't need dark energy.

00:07:20 Speaker 2

Or dark matter to explain how the universe behaves.

00:07:24 Speaker 1

Hold on, dark energy and dark matter. Those are kind of big deals in cosmology, aren't they?

00:07:28 Speaker 2

They are huge. Dark energy is thought to be behind the accelerating expansion of the universe.

00:07:33 Speaker 1

Right and dark matter is that invisible stuff that supposedly holds galaxies together.

00:07:38 Speaker 2

Exactly. But FUGE says we don't need either of them. It explains expansion through its idea of granular expansion.

00:07:46 Speaker 1

And it accounts for the missing mass through this continuous addition of mass energy we were talking.

00:07:51 Speaker 2

About precisely so in a way, FUGE is offering a simpler explanation.

00:07:51

Chris.

00:07:56 Speaker 1

No need to invent these mysterious invisible entities.

00:07:58 Speaker 2

Right. But here's the catch. There's always a catch, right?

00:08:01 Speaker 1

There always is haha. What's the catch with FUGE well.

00:08:04 Speaker 2

Well, if we definitively prove that dark matter and dark energy do exist.

00:08:09 Speaker 2

Then FUGE would have some explaining to.

00:08:11 Speaker 1

Do because it's built on the idea that.

00:08:13 Speaker 1

We don't need them.

00:08:14 Speaker 2

Exactly. It's like having two different maps that both lead to the same destination.

00:08:18 Speaker 1

We need more data to figure out which map is more.

00:08:20 Speaker 2

Accurate precisely so.

00:08:23 Speaker 2

FUGE is promising, but it hinges on this big unknown about dark matter and.

00:08:29 Speaker 1

Energy. OK, so far we've covered the flat part of FUGE, the granular expansion and how it deals with the whole density question. It's a lot to wrap our heads around, that's for sure. Where do we even go from here?

00:08:40 Speaker 2

Well, now that we've laid the groundwork, I think it's time to delve into the really mind-bending stuff. What FUGE means for the beginning and the end of the universe for life itself.

00:08:51 Speaker 1

Sounds like we're about to get philosophical.

00:08:53 Speaker 2

Things are about to get very.

00:08:54 Speaker 2

Interesting, but for that we'll have to wait for Part 2 of our deep dive into FUGE.

00:08:59 Speaker 1

See you there. Hashtag TTS the deep Dive episode 2020 four 1117 Part 2 of three.

00:09:05 Speaker 2

Welcome back. Ready for more FUGE?

00:09:08 Speaker 1

Oh, I'm ready to dive back in. Part 1 definitely left my head spinning with all this talk of flatness, granular expansion, and mysterious extra mass energy.

00:09:16 Speaker 2

Well, get ready for even more mind-bending concepts, because today we're going to tackle some really big questions like the beginning and the end.

00:09:23 Speaker 1

Like what?

00:09:24 Speaker 1

Of the universe. OK. Yeah. Those are pretty big questions.

00:09:28 Speaker 2

Exactly. And FUGE has some pretty unique answers to them.

00:09:32 Speaker 1

Well, I'm all ears. Let's start with beginnings. The Big Bang is kind of a cornerstone of cosmology these days, isn't it?

00:09:38 Speaker 2

Yeah, the idea that the universe started from a single point and has been expanding ever.

00:09:43 Speaker 2

Since.

00:09:43 Speaker 1

This FUGE throw that whole idea.

00:09:46 Speaker 1

Out the window in.

00:09:47 Speaker 2

A way it does FUGE doesn't require a Big Bang in the traditional sense. It actually proposes a universe that's eternal.

00:09:55 Speaker 1

Meaning.

00:09:55 Speaker 2

Meaning it has no beginning and no end.

00:09:58 Speaker 2

It's always existed and always will.

00:10:00 Speaker 1

Woe. So no dramatic origin story. No singularity, where everything burst into existence.

00:10:06 Speaker 2

Note the universe, according to FUGE, has just always been here.

00:10:10 Speaker 1

That's a pretty massive shift in perspective, but if the universe is eternal with no beginning, doesn't that mess with some other big ideas in physics like entropy?

00:10:18 Speaker 2

You're thinking of the heat death of the universe, right?

00:10:20 Speaker 1

Yeah, that everything tends towards disorder that eventually the universe will just sort of run out of scheme.

00:10:26 Speaker 2

That's the conventional view, yes.

00:10:28 Speaker 2

Entropy is a fundamental concept in thermodynamics and it does suggest that the universe is slowly winding down.

00:10:34 Speaker 1

Like a clock running out of energy? Yeah.

00:10:36 Speaker 2

Exactly or like a cup of coffee cooling down until it reaches room temperature. No more heat to extract, no more potential for change.

00:10:44 Speaker 1

Right, right. But FU?

00:10:46 Speaker 1

GE throws a wrench in that, doesn't it?

00:10:48 Speaker 2

Does if the universe is constantly gaining new mass energy, as FUGE suggests, it's like we're continuously reheating that cup of coffee.

00:10:57 Speaker 1

So instead of cooling down, the universe stays hot well.

00:11:02 Speaker 2

Not exactly hot in the traditional sense, but this influx of energy would counteract that tendency towards entropy that winding down process.

00:11:10 Speaker 1

So the universe never reaches a state of equilibrium.

00:11:12 Speaker 2

Right. It would always be in flux, always dynamic, always creating new structures.

00:11:16 Speaker 1

So instead of a slow fade out, it's more like a never-ending dance.

00:11:20 Speaker 2

That's a great way.

00:11:20 Speaker 2

To put it a perpetual cycle of creation and.

00:11:23 Speaker 2

Destruction driven by this constant addition of mass energy.

00:11:26 Speaker 1

OK, I have to admit that's kind of a more appealing picture than the cold, dark void we usually imagine.

00:11:31 Speaker 2

Uh-huh, it definitely is. But here's the thought. If the universe has always been here, does that mean it's static? Unchanging.

00:11:39 Speaker 1

Yeah, that's a good point. Is there still room for evolution in an eternal universe?

00:11:43 Speaker 2

Absolutely. Remember, Fugue proposes that the universe is constantly expanding and gaining new mass.

00:11:49 Speaker 2

Energy that creates a very dynamic environment.

00:11:52 Speaker 1

Right. Things are always shifting, even if there's no beginning or.

00:11:55 Speaker 1

End.

00:11:55 Speaker 2

Exactly. So the universe, according to FUGE, would be ancient and eternally young, constantly renewing itself.

00:12:03 Speaker 1

It's a pretty mind-blowing concept, but what about us? What does an eternal evolving universe mean for life, for humanity?

00:12:10 Speaker 2

Well, if huge doesn't offer any guarantees, survival would still depend on adaptation.

00:12:15 Speaker 1

Right. The universe might be constantly changing, but life still has to keep.

00:12:19 Speaker 1

Up.

00:12:19 Speaker 2

Exactly.

00:12:20 Speaker 2

But FUGE does suggest that life itself could be eternal, constantly finding new ways to thrive.

00:12:25 Speaker 1

So it's not a story of inevitable doom and gloom.

00:12:28 Speaker 2

Not necessarily. The universe, according to FUGE, is inherently hospitable to life, always creating new niches and opportunities.

00:12:35 Speaker 1

OK, so this model is saying the universe is eternal, constantly evolving, and maybe even teeming with.

00:12:43 Speaker 1

It's a lot to take in.

00:12:44 Speaker 2

It is and it's important to remember that this is all based on the work of a.

00:12:47 Speaker 2

Single Blogger.

00:12:49 Speaker 1

Right, this isn't exactly mainstream cosmology yet.

00:12:51 Speaker 2

Not quite. FUGE hasn't been widely embraced by the scientific community. Some of his predictions are hard to test with current technology, and it does challenge a lot of deeply ingrained assumptions.

00:13:02 Speaker 1

So it's a bit of an underdog theory.

00:13:04 Speaker 2

For now.

00:13:04 Speaker 2

Yeah, but who knows, maybe it will spark new research and lead to new discoveries.

00:13:08 Speaker 1

It's definitely sparked my curiosity, but before we get carried away with all the mind-blowing possibilities, I want to bring us back to the observable universe for a minute. We've talked about FUGE's core principles, but how does it explain the things we actually see out there, like the red shift of distant galaxies?

00:13:24 Speaker 2

That's a crucial question, and it's one we'll tackle on the final part of our.

00:13:28 Speaker 2

Deep dive state.

00:13:28 Speaker 1

Stay tuned hashtag TTS the Deep dive episode 20/24 11:17 part three of three.

00:13:36 Speaker 2

Welcome back to our deep dive on FUGE. Are you ready to finish this thing up? I am. And honestly, I'm kind of sad to see it go. It's been such a fun exploration.

00:13:46 Speaker 1

Yeah, it's definitely stretched my brain in all kinds of directions. We've talked about a flat universe, granular expansion, this constant influx of mass energy, and a universe that might be eternal.

00:13:58 Speaker 1

That's a lot to digest.

00:13:59 Speaker 2

It is a lot, but today we're grounding ourselves a bit. We're going to look at how FUGE actually explains what we see in.

00:14:06 Speaker 1

The universe, right. Because our model is only as good as its ability to match the.

00:14:10 Speaker 2

Data right, exactly a theory can sound cool and all, but if it doesn't match up with what we observe, then it's not.

00:14:16 Speaker 1

Very useful. So let's start with something pretty basic, something we've all heard of.

00:14:20 Speaker 1

Redshift.

00:14:21 Speaker 2

Ah yes, the redshift of distant galaxies.

00:14:24 Speaker 1

Right, we observe that the farther away a Galaxy is, the more its light is shifted towards the red end of the spectrum, and we usually interpret that as evidence that the universe is expanding with those galaxies moving away from us. How does FUGE fit into this picture?

00:14:38

Well.

00:14:39 Speaker 2

FUGE agrees that the universe is expanding.

00:14:42 Speaker 2

But it offers a slightly different take.

00:14:44 Speaker 2

On red shift.

00:14:45 Speaker 2

Remember how we talked about space itself, stretching in this model?

00:14:48 Speaker 1

Yeah, those grains of space being added all the time.

00:14:51 Speaker 2

Right. So as light travels through this expanding space, its wavelength gets stretched.

00:14:56 Speaker 1

Too. So it's not that the galaxies themselves are moving away from us at incredible speeds. It's that the space between us and them is growing, stretching the light as it travels.

00:15:05 Speaker 2

Precisely. It's like, imagine an Ant walking across a rubber band. Yeah, the Ant isn't walking any faster, but the distance it covers increases because the rubber band itself is getting longer.

00:15:09 Speaker 1

While you're stretching it.

00:15:16 Speaker 1

OK, I can pick.

00:15:17 Speaker 1

For that.

00:15:18 Speaker 1

But what about the relationship between red shift and distance? We observe that the farther away a Galaxy is, the greater its red shift. How does FUGE explain that?

00:15:28 Speaker 2

Well, think about it. The farther away a Galaxy is, the more of those grains of space have been added between us and that Galaxy over time.

00:15:36 Speaker 1

Meaning the light from those really distant galaxies has been travelling for a longer time.

00:15:41 Speaker 2

Exactly. So it's had more opportunity to be stretched, leading to a larger red shift.

00:15:45 Speaker 1

OK. That makes sense. So the more space between us and a Galaxy, the more its light gets stretched out, resulting in a bigger red shift.

00:15:53 Speaker 2

That's the idea. Now, what about the cosmic microwave background radiation?

00:15:58 Speaker 1

Ah yes, the CMB. It's this faint afterglow of heat that's everywhere in the universe, and it's usually seen as one of the strongest pieces of evidence for The Big Bang.

00:16:08 Speaker 2

It's a pretty big deal in cosmology, for sure.

00:16:10 Speaker 1

But FUGE doesn't accept The Big Bang as the beginning, does it? So how does it explain the CMB?

00:16:16 Speaker 2

It sees the CMB as a result of the thermalization of all that energy that's constantly being added to the universe.

00:16:22 Speaker 1

Wait, break that down for me.

00:16:23 Speaker 2

OK, so remember all that mass energy being woven into space time.

00:16:27 Speaker 2

Well, all that energy.

00:16:28 Speaker 2

Spread out and eventually reaches a uniform temperature.

00:16:31 Speaker 1

It reaches a state of equilibrium.

00:16:33 Speaker 2

Right. And the CMB in the FUGE model is the leftover radiation from this ongoing process of energy being added and then reaching that equilibrium.

00:16:42 Speaker 1

So instead of being leftover heat from The Big Bang, the CMB in FUGE is more like a constant hum from all this new energy being added to the universe.

00:16:51 Speaker 2

That's a good way to put it. It's not a relic from a single event, it's a constant background noise from this ongoing process.

00:16:58 Speaker 1

OK, so FUGE can offer alternative explanations for both the redshift of galaxies and the cosmic microwave background.

00:17:04 Speaker 1

Question pretty.

00:17:06 Speaker 1

It does raise some eyebrows, that's for sure, but is there anything that FUGE has trouble explaining anything? It just can't account for?

00:17:12 Speaker 2

Account for well, like any model, FUGE isn't perfect. It's still a young theory, and there are definitely areas that need more work.

00:17:19 Speaker 1

Like what? What are some of its weaknesses?

00:17:22 Speaker 2

Well, for one, it's not entirely clear how FUGE accounts for the observed abundance of light elements in the universe. The Big Bang model explains this through its theory of nucleosynthesis, which works pretty well.

00:17:33 Speaker 1

So there are still some.

00:17:34 Speaker 1

Wrinkles to iron out. Ohh.

00:17:35 Speaker 2

For sure, FUGE needs more rigorous testing, more development, maybe even some revisions to address all the questions it raises.

00:17:42 Speaker 2

Is, but that's how science works.

00:17:44 Speaker 1

Right trial and error. Always trying to refine our understanding.

00:17:47 Speaker 2

Exactly. And even if FUGE doesn't turn out to be the correct model of the universe, it's still been an incredibly valuable exercise.

00:17:55 Speaker 1

Yeah, it's gotten us thinking in new ways, challenging our assumptions, exploring possibilities.

00:18:01 Speaker 2

And that's what makes cosmology so exciting.

00:18:04 Speaker 2

There's still so much we don't know so much left.

00:18:05 Speaker 1

To discover well said.

00:18:07 Speaker 1

So as we wrap up this deep dive into flat, uniform granular expansion.

00:18:13 Speaker 1

I have to say it's been a wild ride.

00:18:16 Speaker 2

Ah, it has from the very concept of a flat universe to the mind-boggling possibility of an eternal, ever evolving cosmos.

00:18:25 Speaker 2

FUGE has really pushed the boundaries of our imagination.

00:18:28 Speaker 1

And it's reminded us that our understanding of the universe is constantly changing, always being refined as we gather more data and explore new ideas.

00:18:36 Speaker 2

And who knows, maybe one day FUGE or something like it will completely revolutionise how we view the cosmos.

00:18:42 Speaker 1

Well, until then, keep looking up, keep asking questions and keep exploring the universe.

00:18:45 Speaker 2

And we'll see you on our next deep dive.