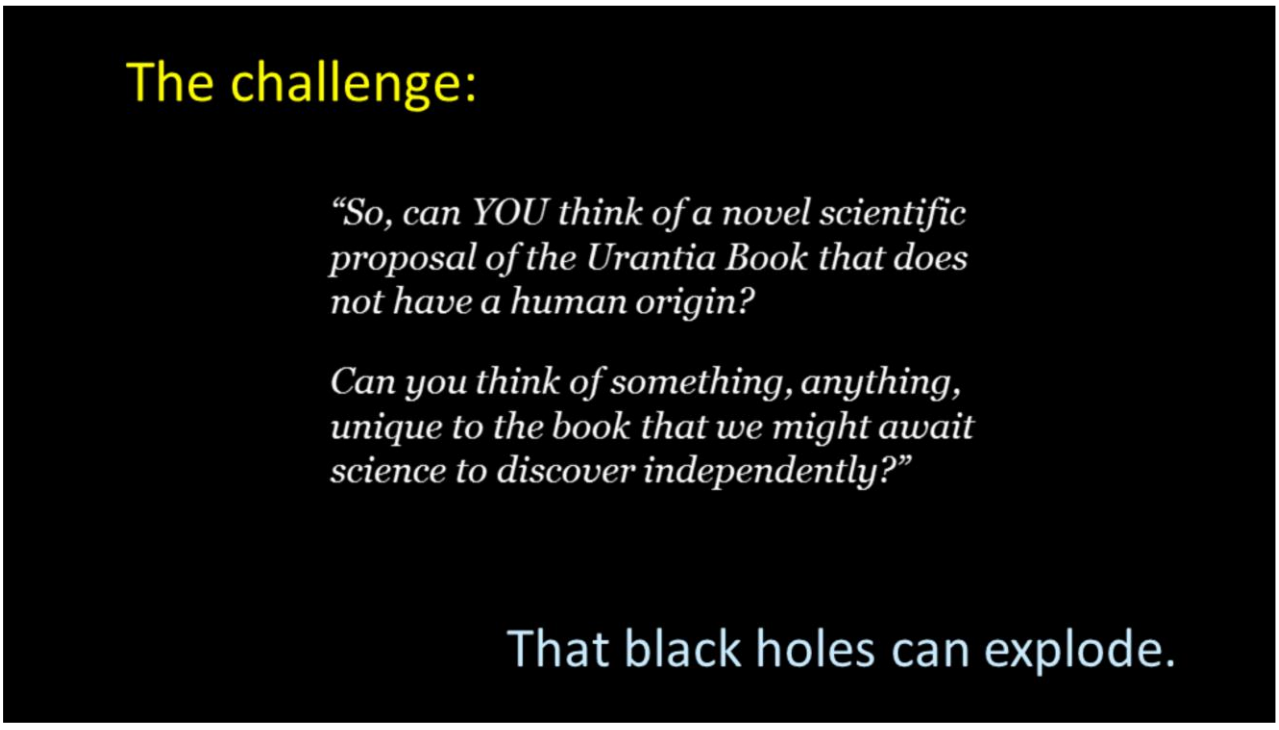
So much for mass and matter.

Let's now think what all this means for **dark islands**, those so-called "black holes in space", and for the Milky Way.

First, dark islands:

My interest in dark islands was stirred by a comment from a long-time reader of the Urantia Book. Like many of us, he started off quite impressed by its fabulous, "sci-fi" cosmology, and for 10 years, he "championed" so-called "Urantia Book science".

But over time, as his naïve assumptions and misunderstandings got undermined, his interest in this "scientific content" cooled off, prompting him to ask (what he thought was) a rhetorical question:



"So, can YOU think of a novel scientific proposal of the Urantia Book that does not have a human origin?

Can you think of something, anything, unique to the book that we might await science to discover independently?"

I could think of a few, but as a student of astrophysics, I'd become intrigued by one in particular. So I replied:

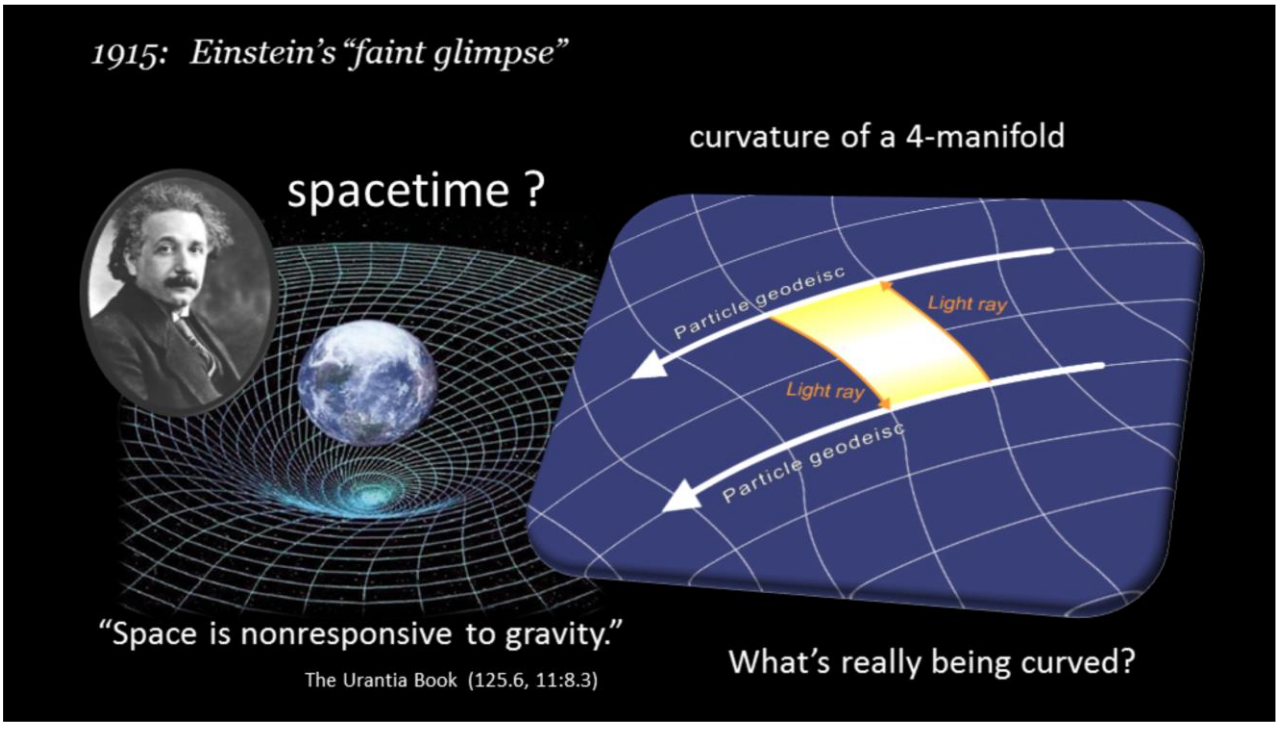
"Here's one: that black holes can explode."

This caught him by surprise. He thought he knew a thing or two about black holes, and that they might be related to what the Urantia Book calls *"**dark islands**"*.

But as everybody knows, *black holes do <u>not</u> explode*.

Besides, where in the Urantia Book does it mention exploding dark islands?
His scepticism was undented, but his curiosity was aroused.

Let's take a look at what I mean.



In 1915, Einstein presented his so-called "**faint glimpse**" (see paper 195 section 7), the idea that gravity – or **one kind of** gravity – involves the **curvature** of a manifold in which particles and planets move.

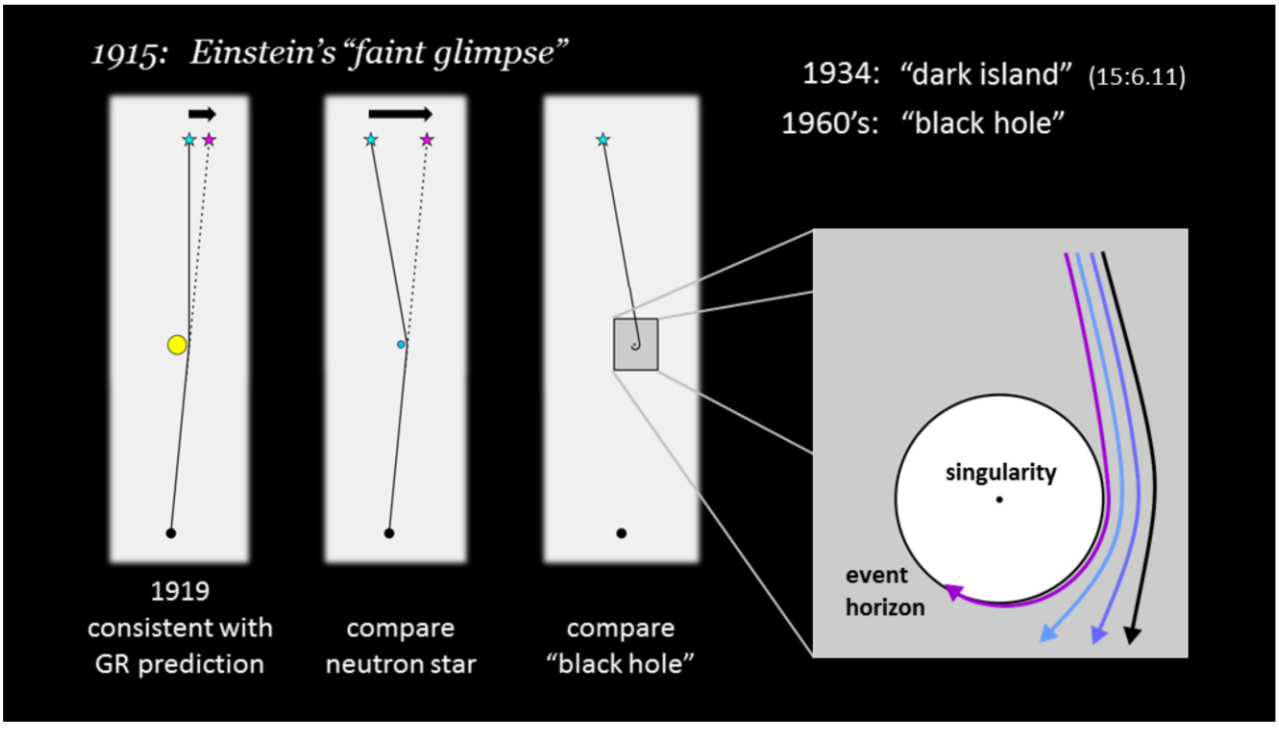
Naturally, Einstein assumed this manifold must be space itself bound up with time, so the idea of **spacetime** was born.

But the Urantia Book upsets this simple view. From paper 11 section 8, [quote]:

"**Space is nonresponsive to gravity**." (125.6, 11:8.3)

"**Space is nonresponsive to gravity**". If space is nonresponsive to gravity, then we have to wonder… in Einstein's theoretical scheme, what's **really** being **curved**?

We'll get back to that. But first, how did science test this new idea, that gravity is related to **curvature**?



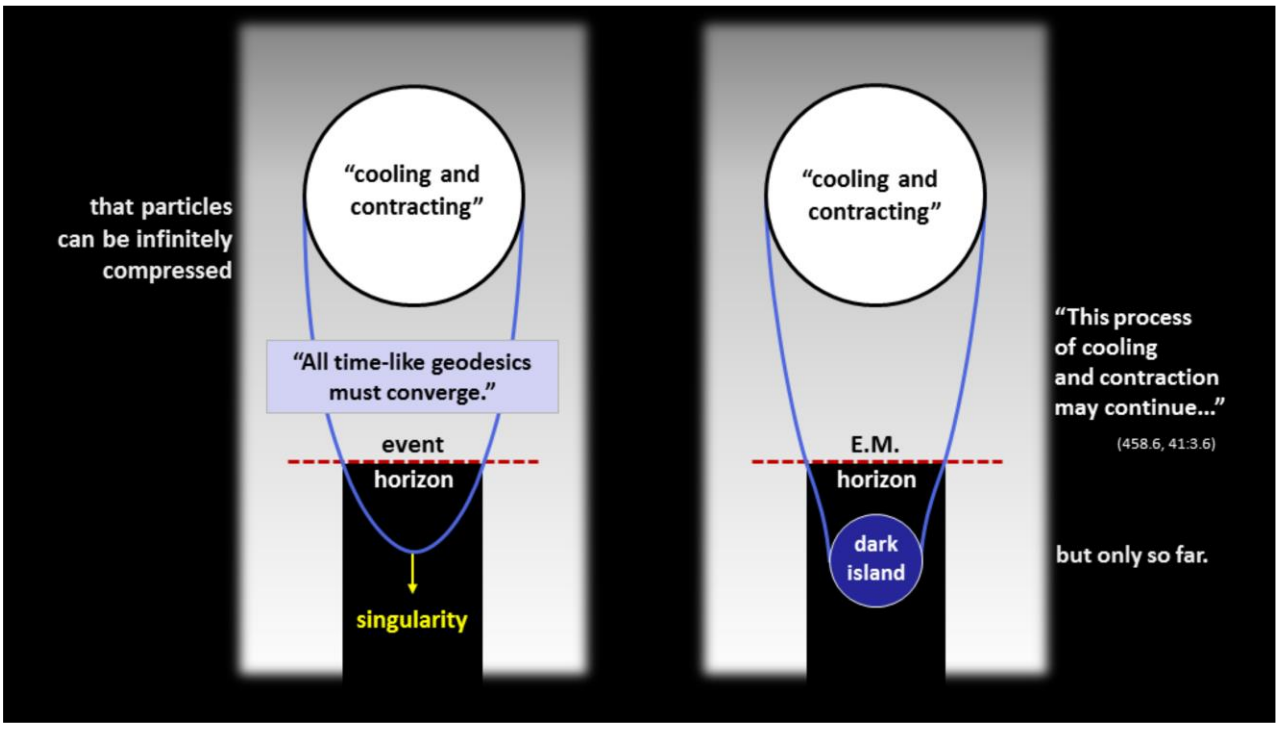
One prediction of Einstein's theory was that the mass of a star should bend the path through space of light. This means that during a solar eclipse, the position of stars behind the sun should seem to shift.

In 1919, this shift was measured; and although the numbers did not quite match, there was indeed a "shift". This apparent bending of the path of light made scientists take seriously Einstein's idea.

But this idea about curvature has implications: as a star cools, it contracts. As it contracts, its density increases, which should increase the local distortion of Einstein's spacetime. For example, the path of a photon passing near a neutron star can be quite sharply bent.

But in this theory, if a cooling and contracting star has enough mass, something weird can happen: it can **disappear**! As the theory goes, if a contracting star shrinks below a certain size, escape velocity exceeds the speed of light, so **light itself** gets trapped. A so-called "**event horizon**" forms, and the place where a star once was goes dark.

In 1934, the author of paper 15 referred to such collapsed objects as one type of "**dark island**" (15:6.11). In the 1960's, when mainstream science got interested, they were given the catchy name "**black hole**".



The standard model view of this collapse depends on two assumptions:

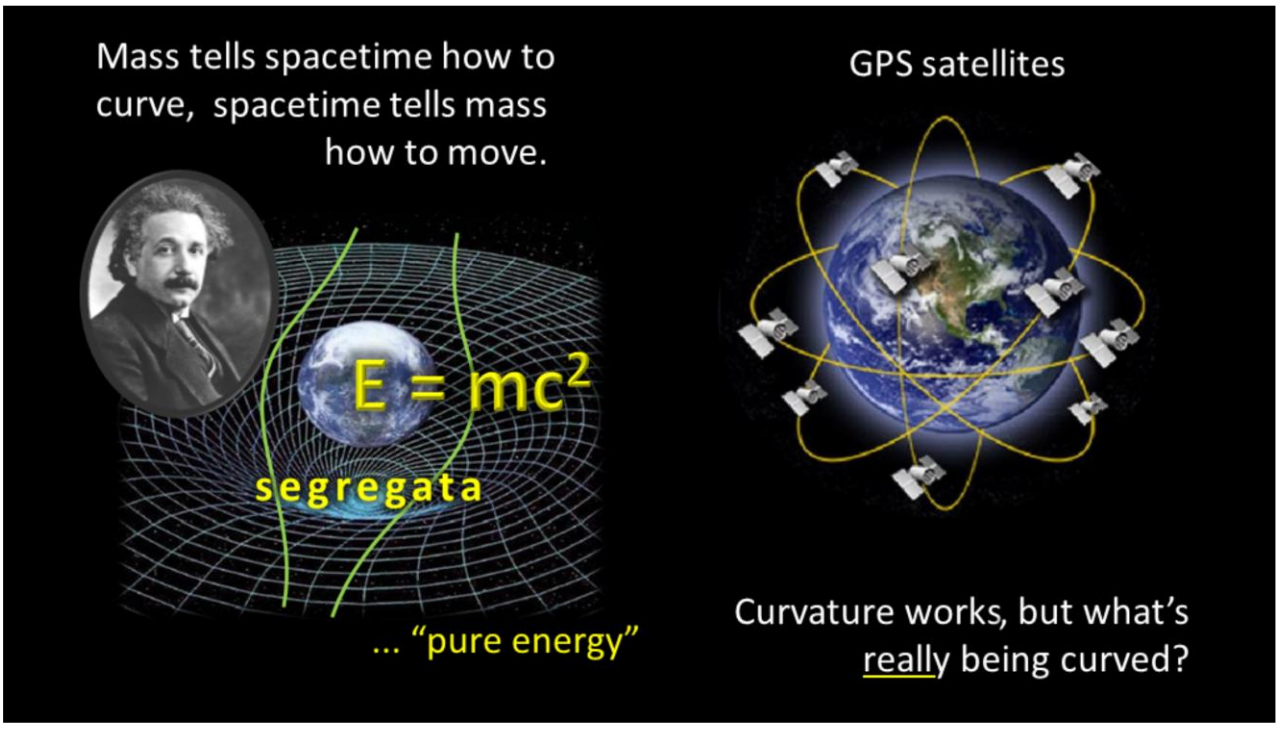
1. that particles are nothing but fluctuations in a field,
   and thus can be **infinitely** compressed.

2. that since the manifold of space itself is being curved,
   "all timelike geodesics must converge..." (that's a technical thing.)

The Urantia Book story is different in two ways. First, with regard to what happens when matter collapses, and second, with regard to what's **really** being "**curved**".

As they say in paper 41 section 3, this "**process of cooling and contraction may continue…**", but only so far. Notice that, at a certain radius, an **electromagnetic** horizon can still form, where escape velocity exceeds the speed of light. Once an object shrinks below this size, it can neither emit nor reflect light. This is the idea behind the Urantia Book's "**dark island**".

But if space is really "**nonresponsive to gravity**", as they say in paper 11 section 8, then the question is: what's really being **curved**?



First thing to say is that the **mathematics** of curvature **works**.

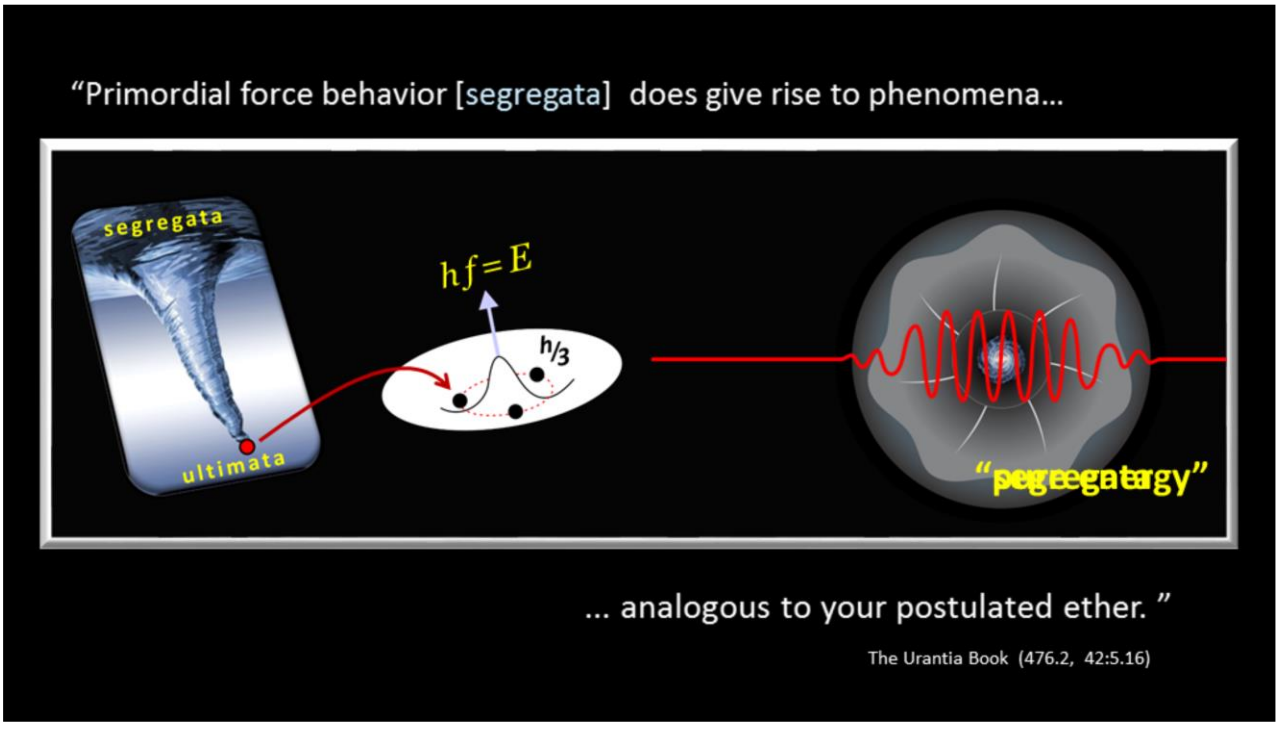
And it works really, really well! As demonstrated every day by mobile phones and GPS navigation, and as confirmed by gravitational lensing.

It's this excellent match – of measurement with theory – that's led science to accept Einstein's geometrical view, that gravity is caused by mass curving space and time. As professor John Wheeler used to say, "mass tells spacetime how to curve; spacetime tells mass how to move."

But Einstein discovered something else: **E = mc^2**. So when we say "mass tells spacetime how to curve", we're really talking about **energy**, and variations… in the **distribution of energy** in space.

Variations in the distribution of energy in space.

Does the Urantia Book say anything about the **distribution of energy** in space?



Recall that, in the Urantia Book story, **segregata** is also called "**pure energy**". So an island of segregata is literally an **island of energy**, **segregated** in space.

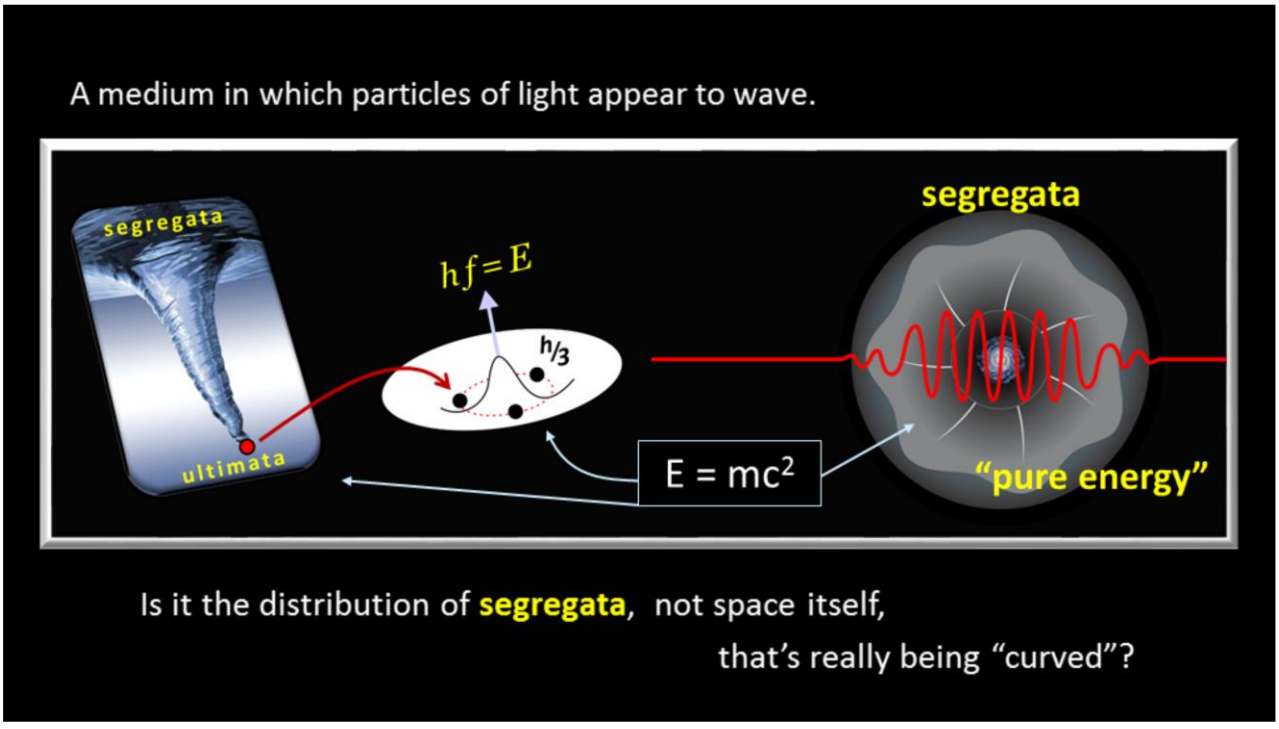
As we saw earlier, **rotating** this island injects angular momentum; and **quantizing** this angular momentum produces **ultimatons**, the "**first measurable form**" of **mass**.

So yes, the Urantia Book says **a lot** about the distribution of **energy** – and about the distribution of **mass** (!)

One more thing about **segregata**. In paper 42 section 5 they say something unexpected. [quote]

> "Primordial-force behavior [**segregata**] does give rise to phenomena which are in many ways **analogous to your postulated ether**." (476.2, 42:5.16).

"Analogous to your postulated ether."



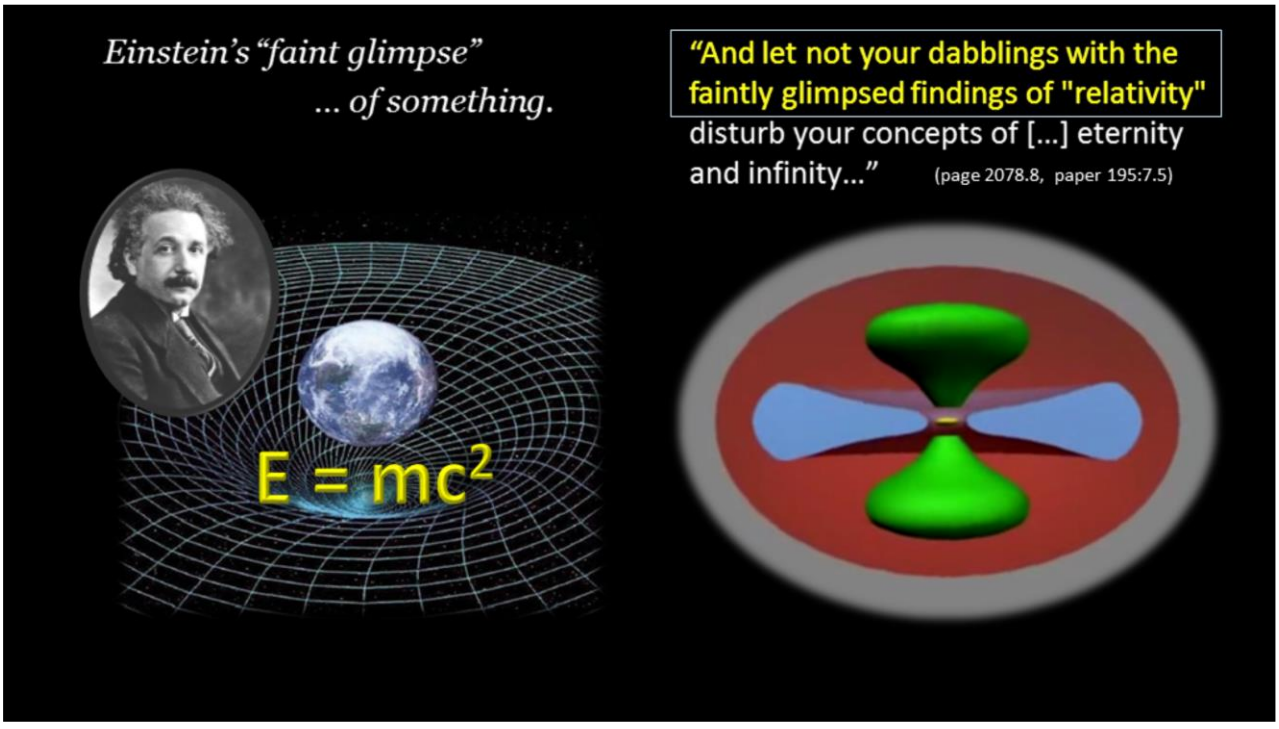
A medium in which particles of light appear to wave.

If "pure energy" or segregata serves as the medium in which particles of light appear to wave, and in which photon geodesics can appear to bend, could it be that the local distribution of segregata – the distribution of energy in space – is what energy-mass can curve, not space itself ?

That's worth repeating:

Is it the **distribution of segregata**, not space itself, that's **really** being curved ?

If "**absolutely ultimate**" space is "nonresponsive to gravity", and if segregata is the medium in which particles of light appear to wave, what does this mean for Einstein's ideas, about light and space and time?



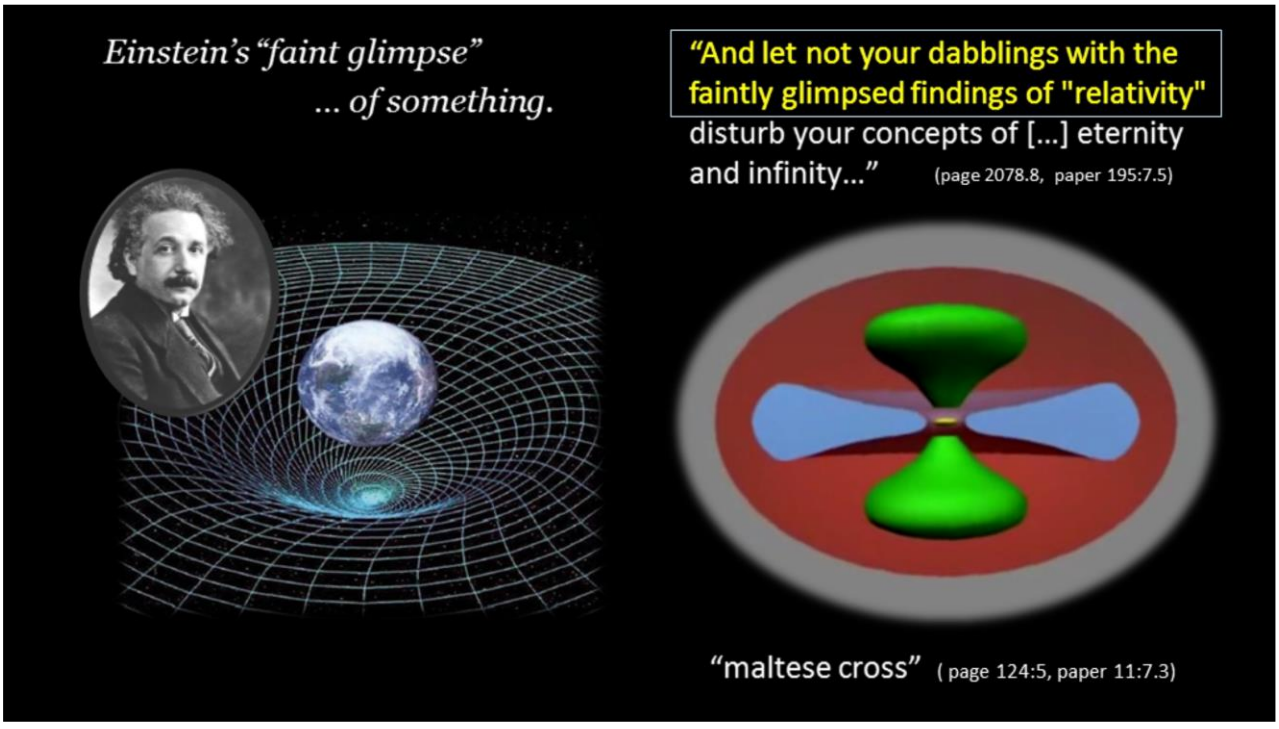
It means that the factors affecting a photon's path through space may be only **faintly glimpsed** in Einstein's relativity. As they say in paper 195 section 7, [quote]

> "And let not your dabblings with the faintly glimpsed findings of 'relativity'… " (2078.8, 195:7.5)

[end quote] To me, this comment implies that Einstein's "**faint glimpse**", his ideas about light and space and time, were a faint glimpse of ***something***. But that "**something**" may be far more complex than Einstein assumed.

For example, here's a 30-second glimpse of some of the so-called "curvatures" involved:

[**Movie: master universe space**]

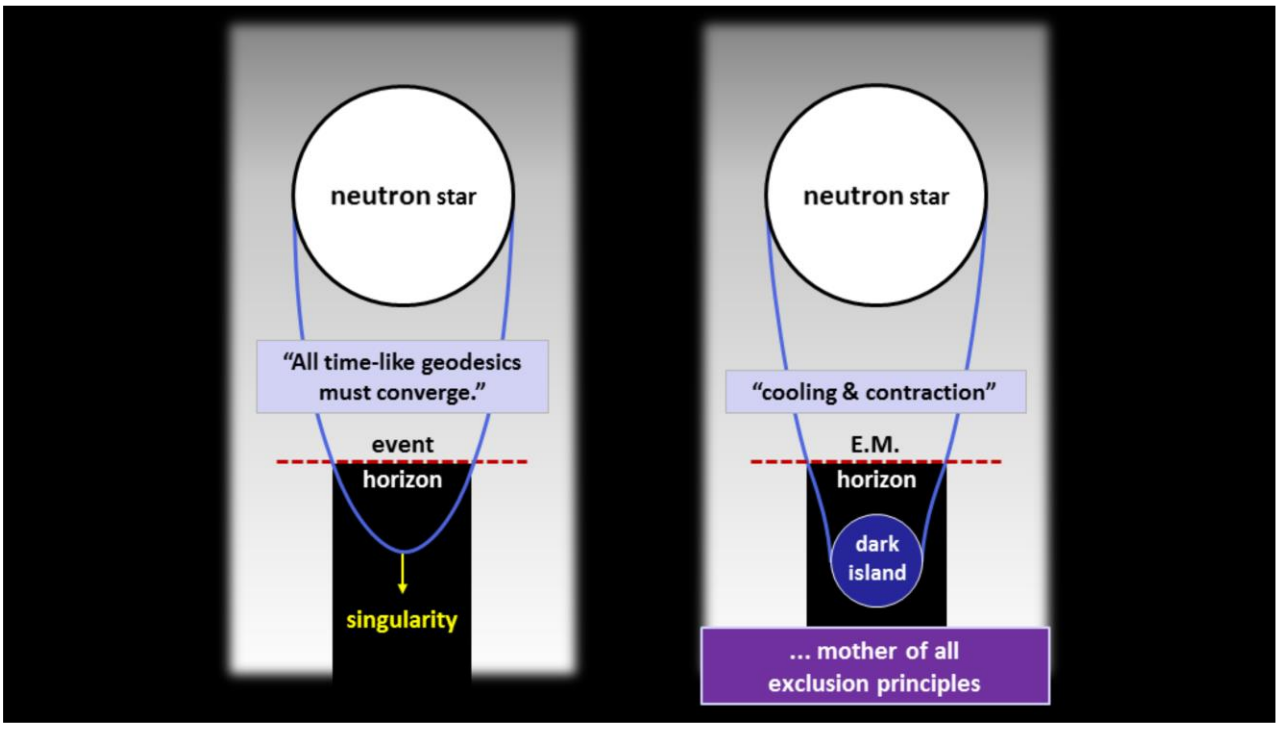


[**Movie: master universe space**]

This is that **rotated Maltese Cross**, described in paper 11 section 7, plus a few cycles of **space respiration**.

As you can see, our physics would need more than Einstein's faint glimpse to accommodate this.

So what does all this mean for black holes and dark islands?



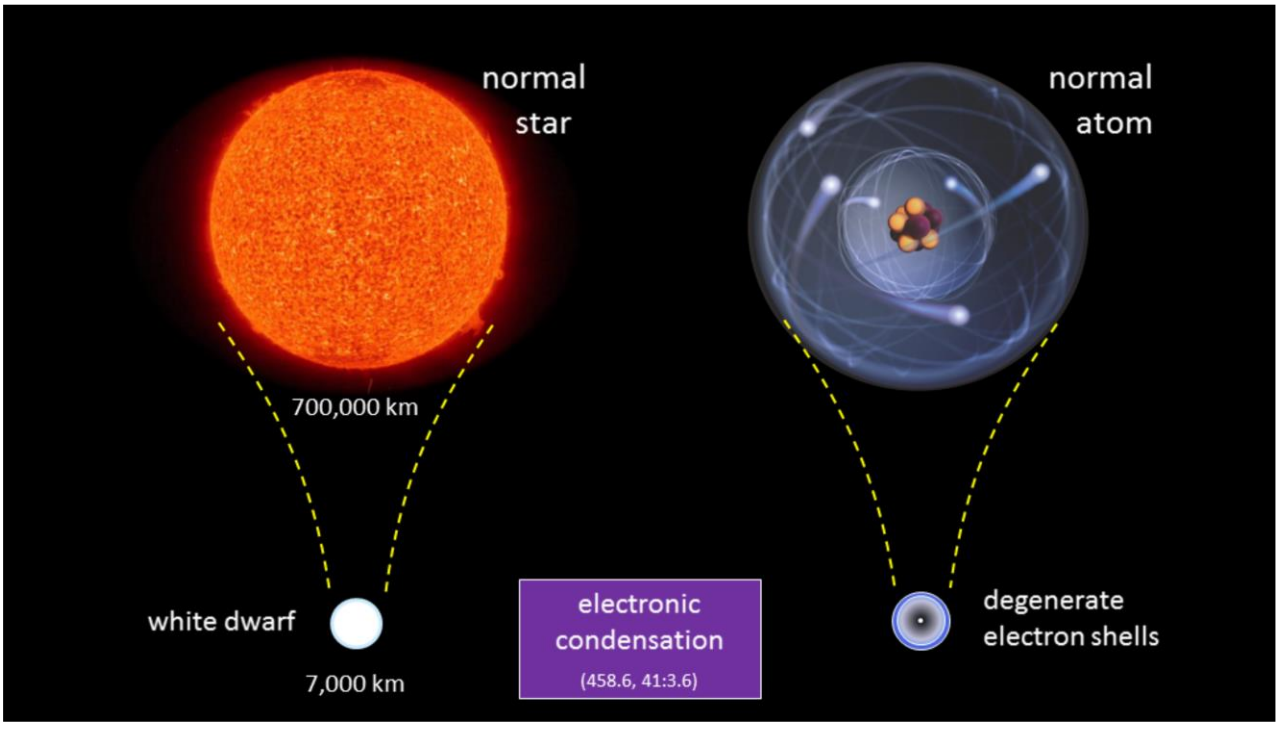
It means that certain standard model assumptions – about particles, and space, and singularities – "ain't necessarily so".

On the other hand, if "this process of cooling and contraction" can be stopped, allowing stable and useful – **stable** and **useful** – dark islands to form, then we face a question:

How does nature stop the collapse of a collapsing neutron star?

The Urantia Book points to something that can do the job,
something we might call… "**the mother of all exclusion principles**".

Let's take a closer look at this "process of cooling and contraction".



After a normal star like our Sun burns up its fuel, it starts to "**cool & contract**".

But normal stars can "**cool & contract**" only so far, ending up as white dwarfs.

What happens is that as this ball of gas starts to **cool**, gravity squashes the atoms closer together, and the star begins to shrink. As it cools some more, electrons are forced closer to protons, and the atoms themselves start to shrink. At this point, a quantum **exclusion principle** kicks in and stops the collapse.

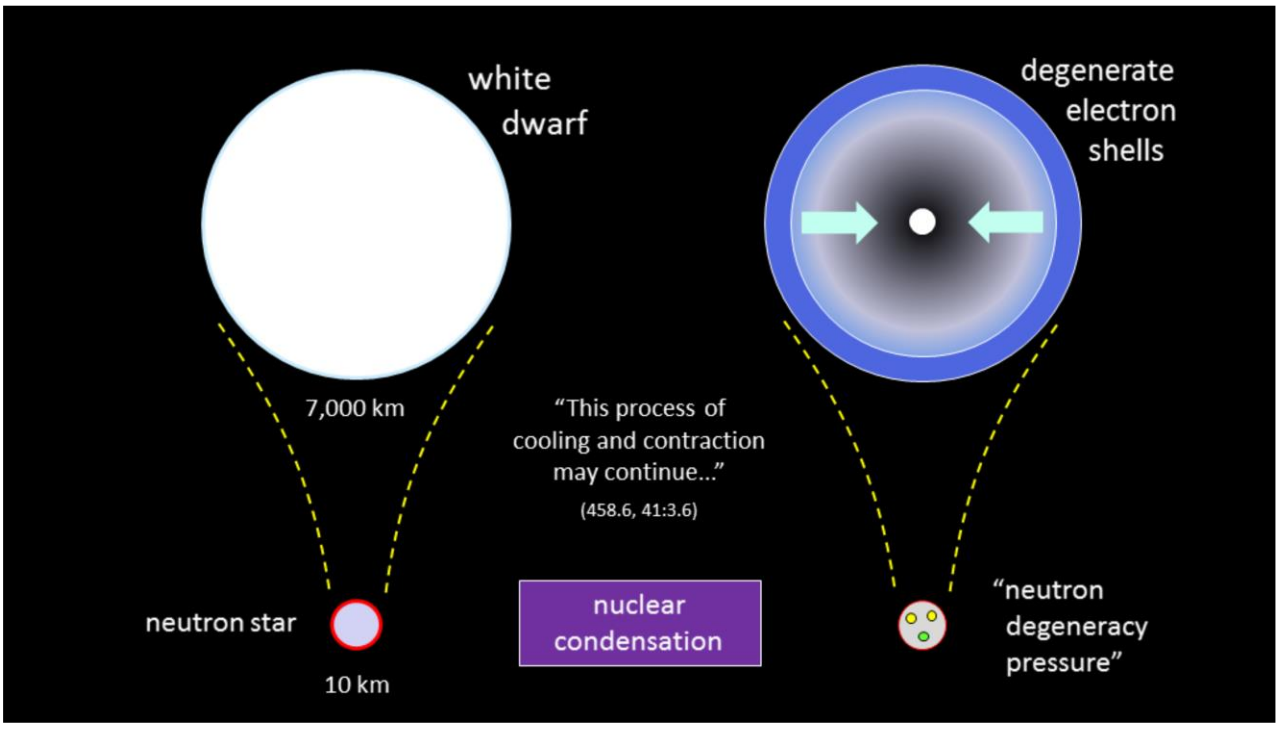
We might call this **the limit** of "**electronic condensation**" (41:3.6)

The idea is that "basic material units" are being brought "closer and closer together".

Worth pausing to consider what's just happened: something the size of the Sun has **collapsed** down to something the size of the earth.

Something the size of the **earth** – a white dwarf.

Ok. Now what if we add **a little more mass** to this cooling and contracting star?



If we add a little more mass, then (from paper 41): [quote]

"this process of cooling and contraction may continue…"

[end quote] If a dying star weighs more than about 1.4 times the mass of our Sun, then gravity wins. Gravity overwhelms the so-called "electron [degeneracy] pressure" and squashes this mass of atoms into a **ball of neutrons** only 10 kilometres across.

A **ball of neutrons** only 10 kilometres across… a **neutron star**.

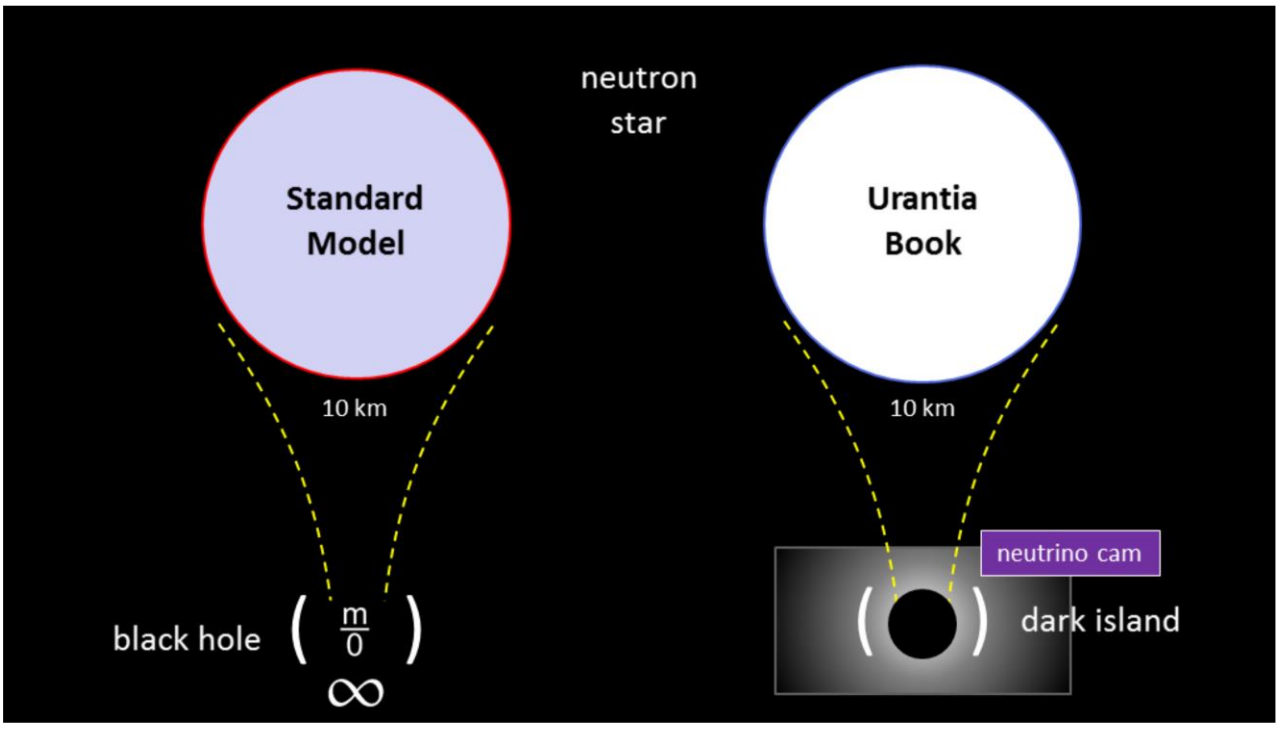
Once again, "basic material units" are being brought "closer and closer together".

Once again, the collapse is stopped by an **exclusion principle**. In this case, "neutron degeneracy pressure". We might call this **the limit** of **nuclear** condensation.

Ok, the story so far:

- A **white dwarf** is what you get when the entire mass of a normal star gets squashed into a volume the size of the Earth, about 7,000 km across.

- A **neutron star** is what you get when **even more mass** is squashed **even smaller**, down to the size of a small city, a mere **10 kilometers** across.



Which brings us to the cutting edge of physics.

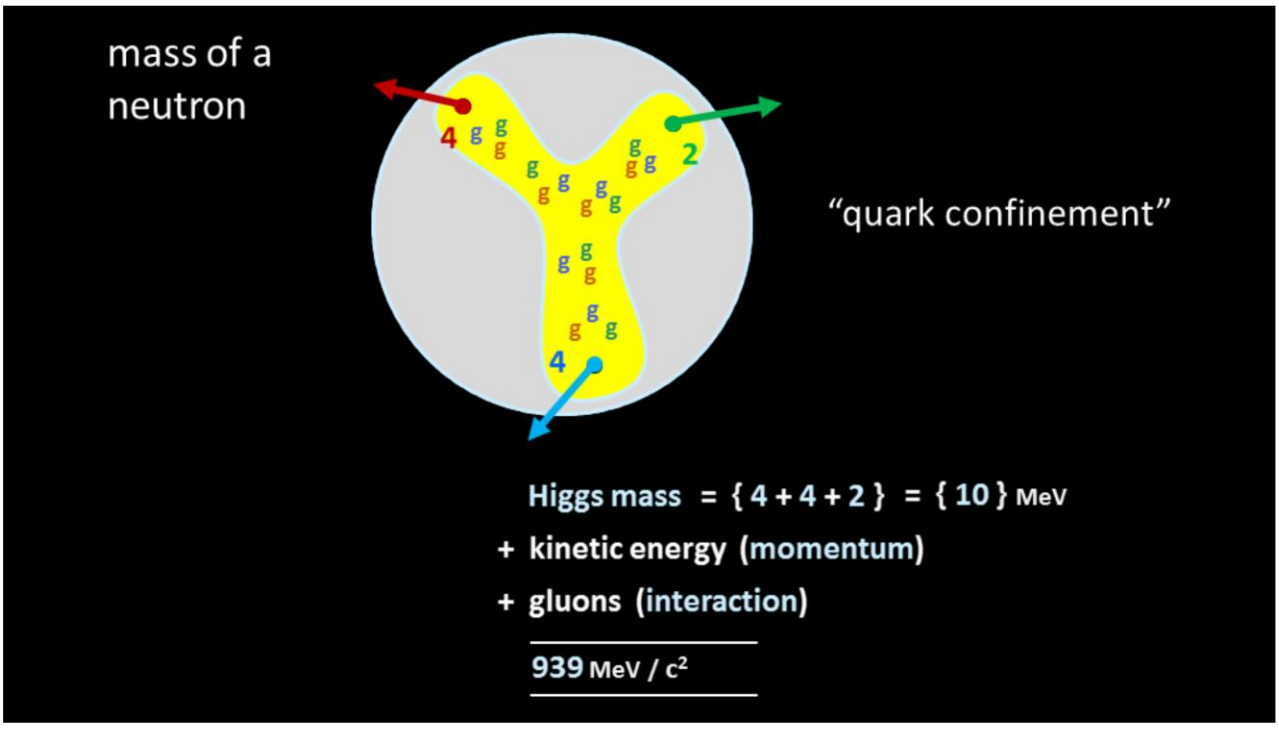
Our "standard models" can handle neutron stars. After all, they're just a bunch of neutrons, packed very, very tight. But if we add a little **more** mass to our cooling and contracting ball, then once again, gravity wins. Core temperatures jump beyond a **trillion degrees**, and the neutrons literally start to **melt**.

Here's where both our standard models start to fall short. Quantum field theory has no way to stop the collapse, so it predicts **infinite density**. And the way cosmology measures space [the metric] no longer works.

But the Urantia Book implies that the collapse of a collapsing neutron star **can** be stopped, allowing one of these so-called "**dark islands**" to form. How does this work?

Well, since this collapse depends on **gravity and mass**, we need to take a closer look at what happens to the **mass** of a neutron star as those neutrons start to melt.

In particular, what happens to the mass of each neutron…



What do we know about the **mass** of a single neutron?

Currently, our standard model treat neutrons as robust little bags that contain three quarks. The "**mass**" of such a bag is about **939** units of… "standard model mass".

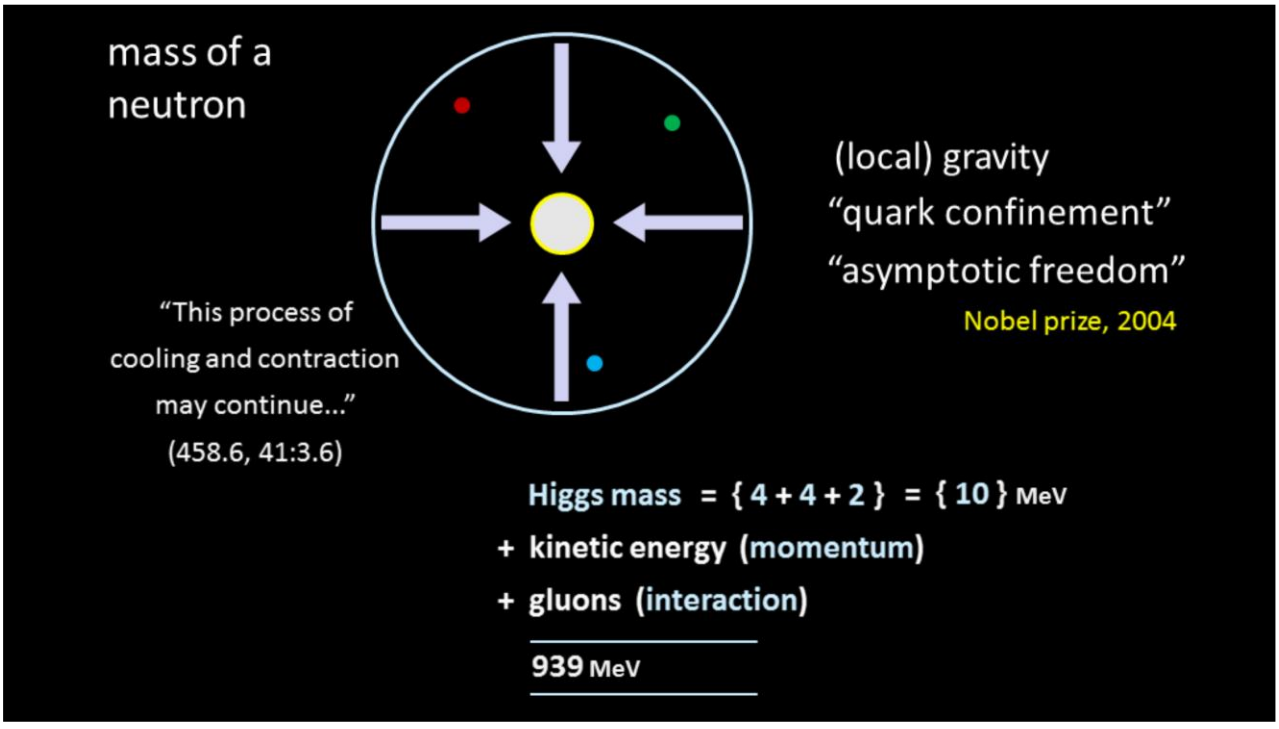
But let's look a bit closer…

The mass these quarks get from a so-called "Higgs-type" mechanism is tiny – only about **10** of these units of mass. That's **only 1 %** of the neutron's measured mass. Where does all the extra mass come from?

It's thought to come from two things: (1) the momentum of the moving quarks, and (2) the weird glue that keeps the quarks together. When we add up all the **energy** involved, all that **mc^2**, we get those 939 units of "**mass**/**energy**".

Crucial to this picture is this weird "nuclear super-glue". It's this **glue** that **confines the quarks**: as the velocity of the quarks pulls them apart, **extra glue** appears to pull them back together… like an unbreakable rubber band.

Of course, **extra glue** means extra **energy**, extra **mc^2** .



But the standard model has another surprise: **asymptotic freedom**.
(This discovery got the 2004 Nobel Prize.)

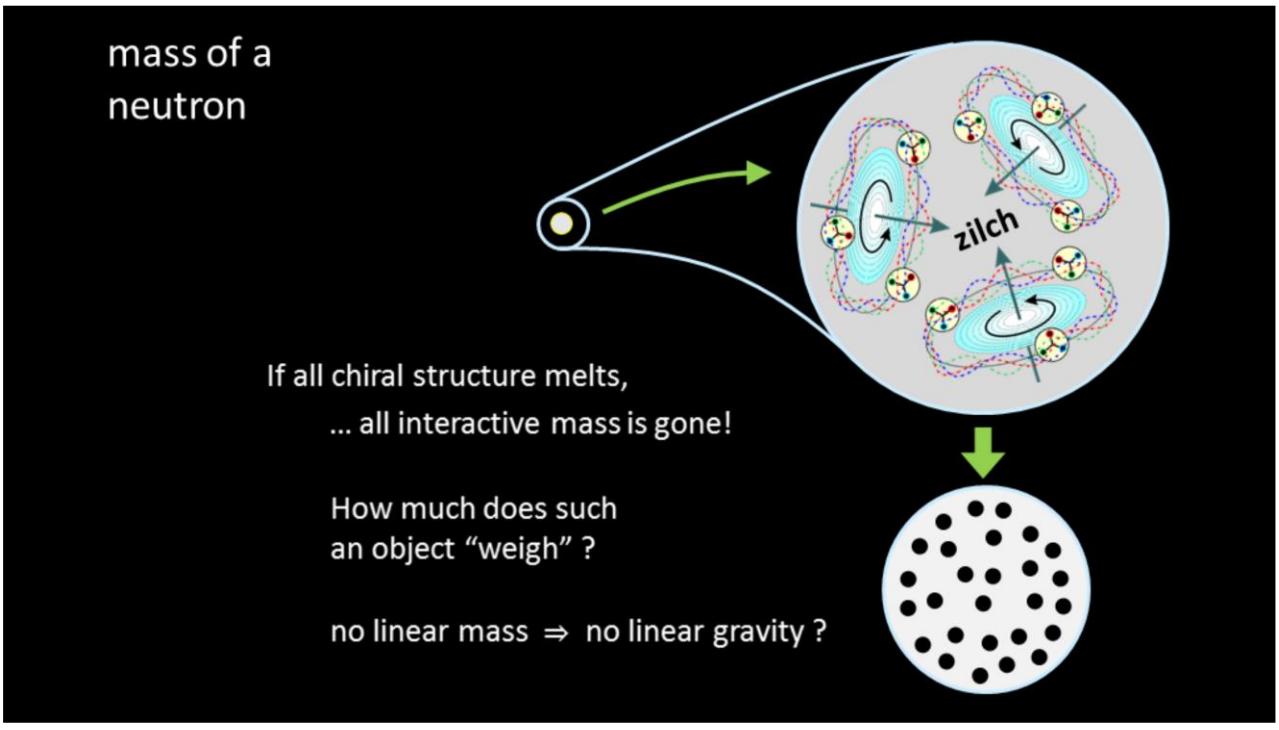
When a neutron's quarks are close together, there's no need for all that glue, so that cloud of virtual gluons… **disappears**. Think what this means in a collapsing neutron star: as those neutrons start to melt, gravity itself can hold the quarks in place. Local gravity replaces the need for gluons to **confine** the quarks.

Now notice something weird: with the need for gluons gone, all that **interactive** mass, from the self-interactions of a cloud of virtual gluons… **disappears**.

And as the range for the quarks to move becomes constrained, so too their momentum… **disappears**.

So here's the question: as the momentum and gluons disappear, **what happens to the mass** of this tiny, compacting ball? Remember, the mass of the quarks themselves was only ever **1%** of the mass of the original neutron. So as the momentum and gluons fade away, up to **99%** of the mass in this collapsing ball… **seems to disappear**.

With such a drastic change of state, with almost all that standard model mass simply gone, you have to wonder: what's really going on inside this "cooling and contracting" ball?



In the Urantia Book story, this "**cooling & contracting**" ball would still be filled with clusters of huddling ultimatons. And remember, it's these clusters that interact with zilch, allowing some "Higgs-type" mechanism to work.

So here's the thing: if these tiny clusters themselves were to melt, there'd be nothing left for a Higgs-type mechanism to flip. Meaning, **all** that interactive (or **linear**) mass is gone.

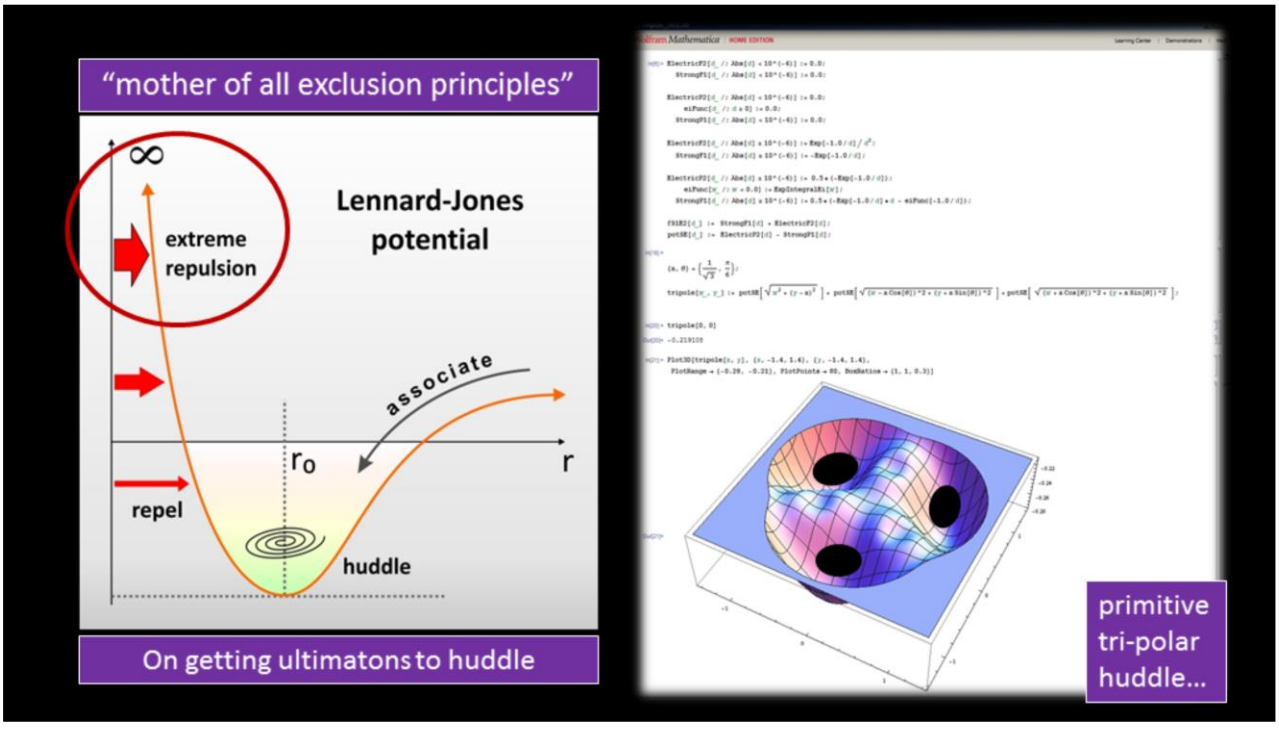
Which raises a question: As this cooling and contracting ball approaches the [quote] "**limiting and critical explosion point of ultimatonic condensation**" [end quote], if **all** the so-called interactive, or linear mass is gone, how much does such an object weigh?

And if "**no linear mass**" means "**no linear gravity**", what local force is left to confine the **agitated** - **absonite** - **attributes** of all those ultimatons?

Remember, in the Urantia Book story, ultimatons are not mere "abstract fluctuations".

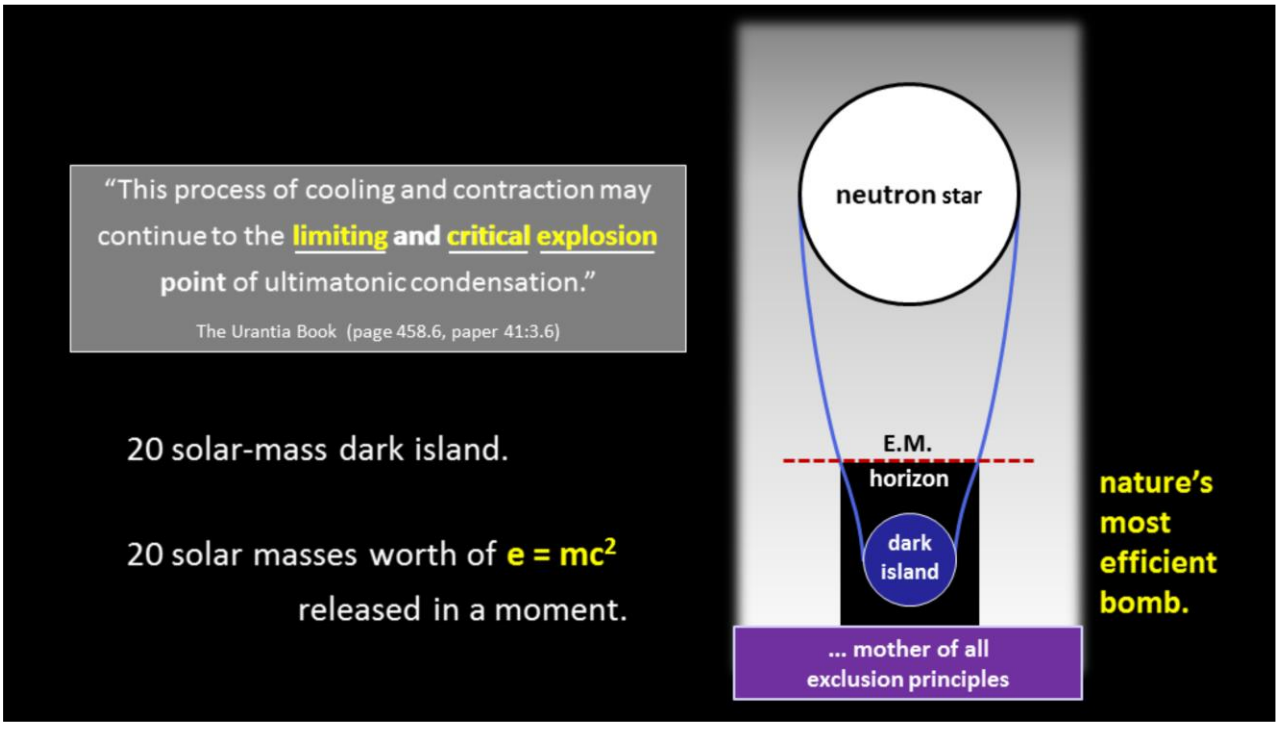
They are the place where nature stores angular momentum, the place where nature locks **absonite energies** onto our finite manifold…

They are a condensate of a condensate of space potency.



Here let’s recall that “**ultimatonic exclusion principle**” I mentioned earlier:

The idea is that if ever the **absonite attributes** of these huddling ultimatons start to overlap, this extreme repulsion, this “mother of **all** exclusion principles” kicks in.



Meaning that this process of "**cooling & contraction**" may continue, but only until this **ultimatonic exclusion principle** stops the collapse. But that's not the end of the story.

From paper 41 section 3: [quote]

> "This process of cooling and contraction may continue to the **limiting** and **critical explosion** point of ultimatonic condensation." [end quote, paper 41 section 3]

The **limiting** and **critical** **explosion** point.

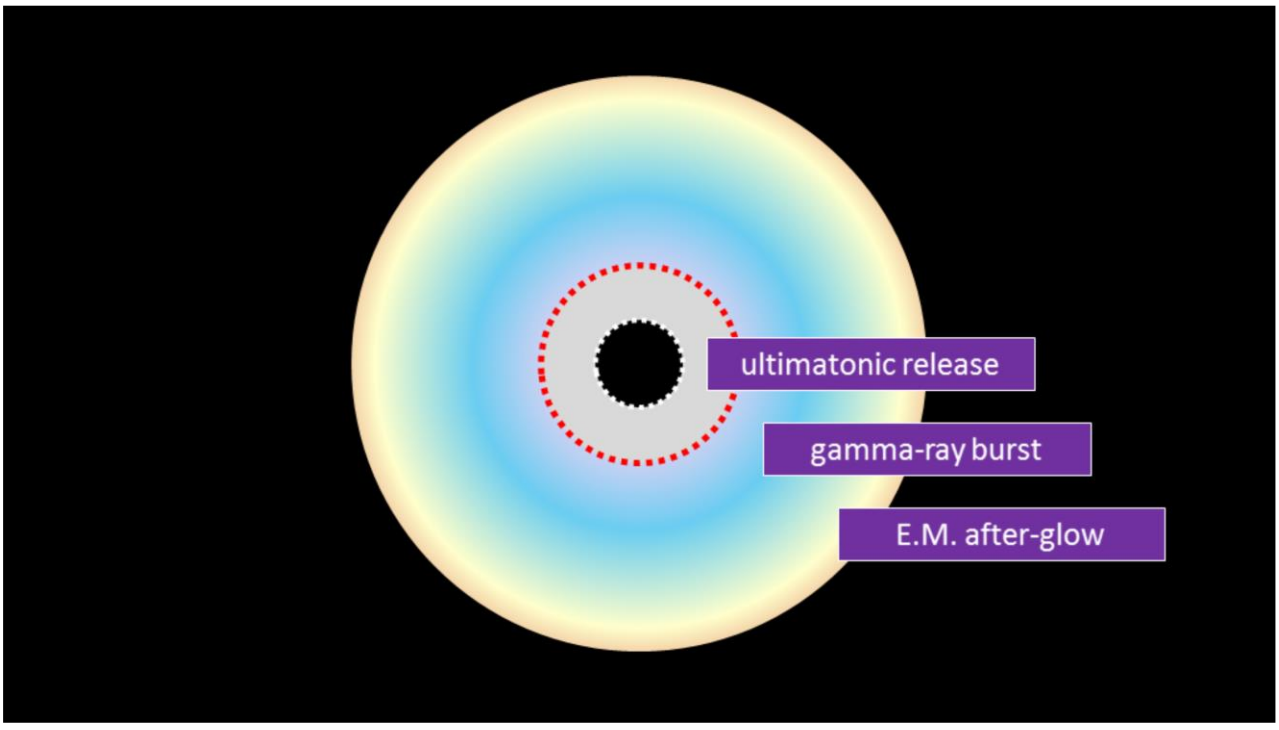
How many ways can we read "**limiting**", "**critical**" and "**explosion**"?

This collapsed star – this invisible ball of mass – **explodes**.

- Imagine a 20 solar-mass dark island:
- 20 solar masses worth of **e = mc^2**
- released in a moment.

As I read this paragraph, as this "**limiting and critical explosion point**" is reached, dark islands become… nature's most efficient bomb.

What sort of bomb?

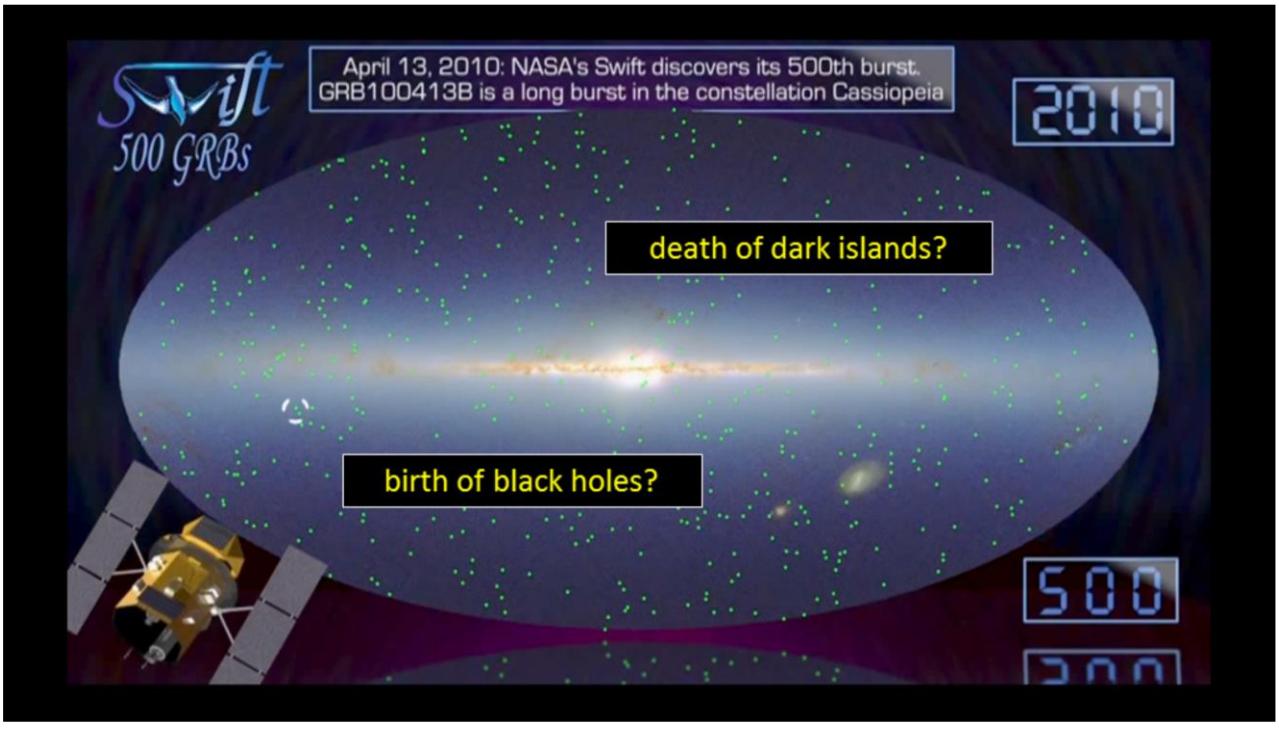


If this “ultimatonic explosion” begins simply as a release of unbound ultimatons, then initially, there’d be no **electrons**, so no electromagnetic light.

The actual, initial explosion may be invisible, or **“dark”**.

Of course, as the initial **ultimatonic commotion** settles down,
there’d be **electromagnetic** effects…

- Like a short-period gamma ray burst,
- followed by some characteristic, tell-tale after-glow.



We've spotted this type of bomb going off ever since we got gamma ray detectors in space. And they remain a mystery.

Here's a snapshot showing the first 500 gamma ray bursts detected by NASA's SWIFT observatory (up to the year 2010).

In the **current** map, the entire sky is filled with such dots.

One explanation – for the short period type of gamma ray burst – is the **birth** of a black hole.

But do they really mark the **birth and death** of dark islands ?

If so, what a neat technique for recycling dead stars!

As we've seen, the Urantia Book tells quite a tale about mass and matter, and dark islands that go "**boom**".

Central to this story are new foundations – for the vast reservoirs of **energy** and **mass** – that science currently can measure, but can't explain.

In the next and final part, we explore what these new foundations might mean for our home sector in an ancient superuniverse – the so-called "Milky Way".

* * *

What do we really know about this Milky Way?