

## 2 years study of gravity and it's effects.

I wondered for a long moment on "how to introduce this"?

After all, 2 years is a long time and so much happened during those years...

so...

How could I give those results?

Stick to scientific data? Shortening it to a simple data entry log would only serve to deter any potential reader.

Give a "vivid collection of memories"? Closer than writing a novel than a scientific paper.

So, I decided to take a step back, let it simmer.

And when I came back at this paper, the answer was right in front of me, in the subject itself I could say.

"we always need a defined referential"

So, there is my referential.

To understand why I decided to lead this study, I need to go back to an event three years old now: the Kyonoke inquest.

To say it was a turning point for me is merely an euphemism.

During the inquest, I tried to do my part on helping find a cure, but I quickly saw that ARC's staff was going to solve all this through their organisation and efficiency.

The second day of the inquest, my long time depression made me gave up on helping for the cure But I thought that I could still make something useful: try to find the murderer of Krug Maetor, the head scientist of the SoCT on the Kyonoke plague.

Nobody seemed to give this murder some attention (and in comparison, of the plague that was ongoing, it was indeed trivial) so I decided that I could at least do that.

I'll spare you the details, but in the end, I traced back his steps bribed a maintenance worker, and, by looking for it's last place of visit, discovered the patient 7.

That's it for the "good" part.

Being infected by a prion meant that us, as capsulleers, would have been the perfect vector of infection: the virus is transported with us when we die, so any station carrying a clone bay could be a nest for the virus.

to be exposed to death in such way was a real trauma for me, as the saying goes: you truly value something only when it has been lost.

After being cured, came the time of the betrayal, at the time I was a true supporter of the Sister of eve, and view their "shady" operations as "nothing more than what concord do". But

during the crisis, a true humanitarian crisis, they did nothing. They had been invited to the Inquest, and not a single one came up.

To say I reacted badly is an understatement, you can go at that time on the IGS and see for yourself. Even today I can't be at ease when someone is talking about them being a true help for the cluster.

As I said, I was suffering from depression and all this stress made me step down from my CEO position and I went on a vacation with my wife for a few weeks.

When I came back, the corporation had fallen apart, for various reasons, but mostly because I didn't plan my leave well enough.

You can guess that it didn't helped my depression.

So I threw myself on my study of gravitation to the point of obsession.

The result was purely academical, poorly written and too heavy for many to read yet too light for the experts to find it interesting.

But at the time it got me on a clear path I needed to get back on my feet.

I left Forge of Univers for good and joined the Khazad Consortium, a conglomerate of non capsulleers corporations led by my wife's family corporation. For economical reasons I was named "CEO" where in reality I'm only one of many directors.

So, good for me and what about it ? You have already read about 600 words and yet still haven't heard a single thing on gravitation or saw a single formula?

Well, yes, but you need context to understand the study in it's globality, so don't worry, the introduction is over, we are getting closer.

## Part 1: Gravitational concepts & Study Subject

Some definitions of the concepts used in this publication.

### ⌘ A Wormhole (WH)

is formed when two spatial anomalies called “harmony point” connect to each other. Most of those points, in new eden, are used by stargates to facilitate the connection between them.

### ⌘ Barycentric coordinates

in Astrophysics, such coordinates are non-rotating coordinates. In this publication, all coordinates are given in a barycentric system centered on the J171805 system's barycenter.

### ⌘ Gravitational wave (GW)

Is formed when enough energy is unleashed, usually it is formed during one-time events like the formation of a black hole or a supernova but can also be produced by more regular events, for example the orbit of binary star-class objects. Their frequencies usually are very low ( $10^{-16} \text{ Hz} < f < 10^4 \text{ Hz}$ ), making it very hard to detect them without the proper equipment.

### ⌘ Ratio matter/energy (Rm/e)

Is a value between 0 and 1 where 0 is pure matter, and 1 pure energy. An example of very high value would be the quantum entanglement particles, where the “speed” is almost instantaneous. Whereas a low ratio would be an interdiction sphere.

What we were looking for in this study, is to observe what influence WH formation.

### 1) In system influence

What factors determine the location of a wormhole? can we predict/influence the apparition of one?

### 2) Destination System Influence

What factors influence a Wormhole's destination? Can we predict and/or influence it?

And during our studies, we noted more and more anomalies appearing in our algorithm and yet, nothing in anoikis had changed so we added a third objective:

### 3) Gravitational Evolution of the New Eden Cluster.

What could influence the gravitational stability of new eden without causing cataclysmic events?

## Part 2: Study Environment & Equipment

Still shaken by the Kyonoke plague and the dislocation of my corporation, the fact that a new shadow emerged from the depth of space by the Triglavian Collective and all the political turmoil that followed was too much for me.

I decided to take a little break of New eden's activities and focus on my study.

After weeks of research, we located what would become our home for the next two years: Azhâru khazad, a Class 1 wormhole known by standard references as J171805.

Centred around class K0 star, aged of 9 billion years, 7 planets are orbiting, 3 of them having moons and only one gas giant.

A quick analysis of the system, both from conventional and one prototype of Mr Sentinel's Spectral analyser showed that the 7<sup>th</sup> planet was not originating from this system but was a rogue planet captured by the gravity well.

The whole system is 8.6 AU wide, with 4.8 AU between the 6<sup>th</sup> and 7<sup>th</sup> planet. Making it a very dense and compact system. Given the age of the system, the stability of the system was more than juste an appearance.

A red giant is clearly visible from this system and its gravity's influence is source of many particularities that I will cover in detail later on. Here, suffice to say that this influence can be considered as an external yet uniform source of gravitational waves.

Our base of operation evolved during those two years. We started with an athanor and all the scientific facilities we needed but knew very well that it was only temporary. Capsuleer's being capsuleers we knew that sooner or later we would have problems maintaining our spatial presence.

Therefore we decided to establish a real colony on the temperate planet. Not a very hospitable place to be honest, we even got some problems with "locals" (details later) but still safer than a station exposed to capsuleers attacks.

To get exploitable results we used multiple independent systems for measurements. Having redundant data was a primordial objective in our study to get reliable results.



J171805 - Star	
Description	Attributes
Luminosity	0.02
Age	9 002 000 000 Years
Radius	115 300 km
Spectral class	K0 V
Temperature	4914 K

We used the following methods to detect these waves

### Method 1: Laser Interferometry Detectors (LID)

Since the GW have a very low amplitude, usual Interferometry methods don't work as simply as in other case (for example a seismic tremor) but the principle stay the same: we measure the variation of a detector between its "restful" value (1) and its "in activity" value (2).

We used two variations of this methods: one that is planet based, another that is space based.

In both cases, the technology is the same: We send a powerful laser that is split in two. Both lasers then have the same frequency but not the same direction. After a determined time, both sub-lasers are measured. The difference between the two frequencies give us the amplitude of the interference. Knowing the range of frequency we monitor, we can know what we are listening at.

One limit of this methods is that it can technically give altered results on certain occasions, but the main advantage is that with 3reception points, we can detect the direction and angle of the emission, therefore giving us the location of the emission point.

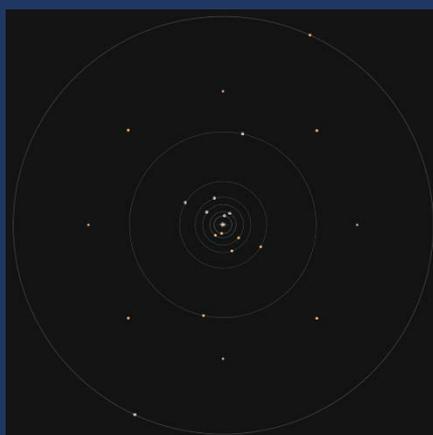
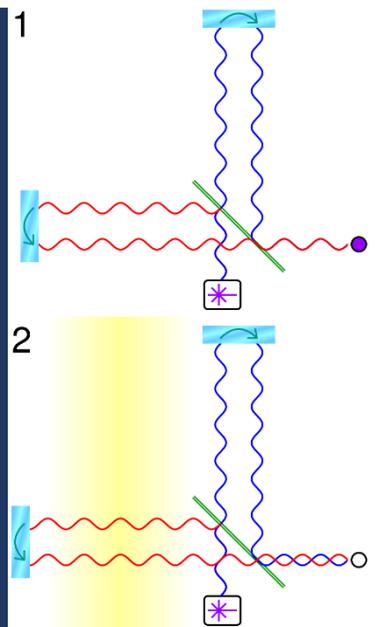
To counter the "default" of this method, we used in parallel a second method.

### Method 2: Resonant Antennae

One property of the gravitational waves is that they are so low in the frequency range that it is almost impossible to isolate something from them.

The principle of a Resonant Antennae is therefore very simple in nature: isolate a detector from everything else. We always used a double RA to double check all results, using two separate design.

One using two coupled spherical superconducting harmonic oscillators a few centimetres in diameter that are designed to have (when uncoupled) almost equal resonant frequencies. And the second is consisting of an exactly machined 1,150 kg sphere cryogenically cooled to 20 millikelvins.

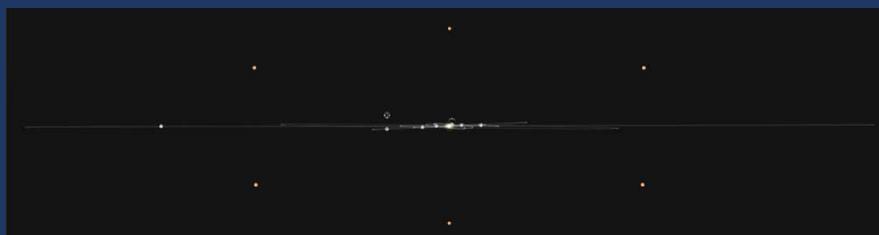


To avoid false-positive and other errors, we took extra care to always use the two methods. The first to be able to locate the source, the second to confirm that it is indeed a gravitational wave and not another source.

For this, we created 6 gravity measurement facilities on the planet, the goal of those labs was to confirm the passage of a GW through the system as well as a formation/experiment center for our scientists.

In space, we used heavily modified UPWELL mobile depots. 7 were placed at Lagrange points of the planets, to reduce the system's own gravitational influence on the data. And 18 more around the system to get as much data as possible.

Through the months we also added 8 prototypes of Mr Sentinel's Analysers on field to test their capacities.



## Part 3: Evolution & Data Obtained

As you can guess, things did not go smoothly.

First, we encountered some problems on the temperate planet. We found some old ruins marking previous settlements there, but if most of them were indeed only ruins of old excavations facilities, one of them was a little more.



Located on a small continent, one of our facilities kept being attacked by local animals, bipedal saurian, showing stone-age technologies. If at first it became obvious that our presence had disturbed their hunting patterns, our counter measure seemed to not be efficient.

After losing some security teams and a lot of time repairing the damage they caused, we finally discovered that they had a vast network of tunnels leading to one of the ruins. We found evidence that a previous scientist had the brilliant idea to use cybernetics and AND-editing to alter and improve some species and left it's work as is (or died at their hand, we are still not sure).

The Board of Khazad consortium, not wanting to destroy a potential "new" species, and yet having a schedule to keep had let me a few months to try to find a peaceful solution, sadly, we could not find someone capable of that in the capsulleer community, and the tunnels were sealed so the species couldn't hinder us any further.

Then, since we were in Anoikis, we were exposed to a lot of capsulleer pressure. If most of them were simple travellers or explorer, there was enough pilots that decided to open fire on our space-based laboratories, damaging equipment, killing qualified people and creating holes in our data collecting pattern.

On January 121 YC we lost our athanor to the hands of the "dangerous voltage" alliance. But thanks to the help of our contacts from Odin's call, we managed to save almost every single person on board of the station.

Odin's call sold us an astrahus at a preferential price to replace our loss and we went back to work.

I'll spare you the details, but the occupation of the WH was economically profitable, which got the board of directors to vote the construction of a Tatara-class station and a few month later, an Azbel-class one to build a rorqual. At that time, data collection was already enough to start to work on them but almost all of our facilities were still inside the WH. So, when on April 13<sup>th</sup> YC 122, we were attacked by a large force from null sec, we decided to evacuate definitely the WH.

But I digress and I suppose you want something more scientific.



Here is the repartition of all the static's location inside our system.

red giant side



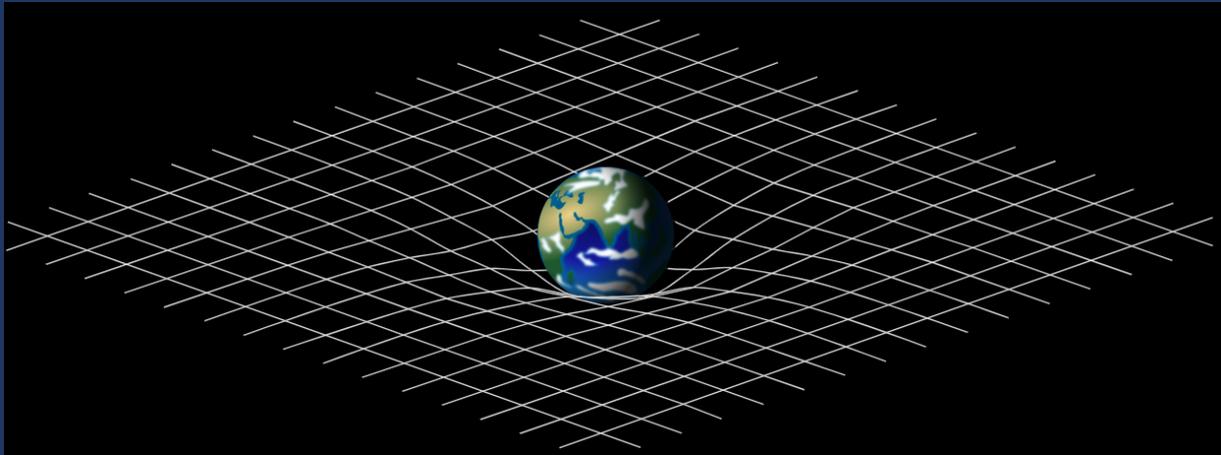
	Average Distance to Barycenter (AU)	Average Closed Time*	Deviation (UA) [exact HPR]	New eden Gravitational fluctuation
YC119 Q4	2,969	20h10	1,2 [2]	1,000
YC120 Q1	2,998	20h40	1,4 [0]	1,001
YC120 Q2	3,057	19h50	1,3 [0]	1,001
YC120 Q3	3,001	19h50	1,1 [2]	1,002
YC120 Q4	2,894	20h00	1,1 [1]	1,003
YC121 Q1	2,87	20h20	0,9 [3]	1,005
YC121 Q2	3,019	20h00	1,1 [1]	1,008
YC121 Q3	2,997	19h50	1,3 [1]	1,013
YC121 Q4	3,058	19h50	1,4 [0]	1,021
YC122 Q1	3,081	14h20	1,1 [0]	1,034

\*Average time before the WH open without intervention (detected by the afflux of gravitational waves from new eden.)

\*\*HPR = Harmony Point Resurgence = a time where the harmony point inside the WH is so stable that the collapsing WH reform at the exact same spot.

## Part 3: Intra-systems Gravitational Analysis & Harmony Point

I'll take a few lines to explain exactly how a Wh connection is formed: take the usual space time representation by a lattice analogy.



This is the representation of a Stress-energy-momentum tensor.

The more energy (either by mass, force, etc) there is at the same point the “deeper” you go.

To understand how a wormhole form naturally, you can take that lattice imagine that an “harmony point” is a point where the energy is virtually null.

And here come the interesting part.

To calculate the tensor's value at a point P(x,y,z) is equal to:

$$t_{LL}^{\mu\nu} = -\frac{c^4}{8\pi G} G^{\mu\nu} + \frac{c^4}{16\pi G(-g)} ((-g)(g^{\mu\nu} g^{\alpha\beta} - g^{\mu\alpha} g^{\nu\beta}))_{,\alpha\beta}$$

where:

$G_{\mu\nu}$  is the Einstein tensor (which is constructed from the metric)

$g_{\mu\nu}$  is the inverse of the metric tensor

$g = \det(g_{\mu\nu})$  is the determinant of the metric tensor and is  $< 0$ . Hence its appearance as  $-g$ .

$${}_{,\alpha\beta} = \frac{\partial^2}{\partial x^\alpha \partial x^\beta}$$

are partial derivatives, not covariant derivatives.

$G$  is Newton's gravitational constant.

And if this equation is equal to null, then the masses of the bodies are not determinant, but in a classic referential, all gravitation is dependant of the distance between the bodies.

Therefore, when the tensor is virtually null, the coordinates are not important anymore.

To better represent this, you can imagine that an intersection become a “hole”, like if the line were fading away.

And that create a “bubble” in the space time continuum. But a “hole” alone isn’t a tube is it not?

And the reason why a WH is “open” when someone warp to it is because the energy used to open the warp tunnel alter the bubble far enough for it to connect to another harmony point (or bubble)

And from this point on, you have a stable connexion between two holes, a tube, a wormhole. With the anomaly as the interface between the two systems.

When looking at the data, one of the first thing that became apparent was the fact that the WH always spawned in the interior of the system: less than 3UA of the barycenter.

With such low variation, at the end, we could scan the exit point in one probe scan with a 96% rate of success.

To retake the problem posed in the beginning:

**What factors determine the location of a wormhole? can we predict/influence the apparition of one?**

We can conclude that a system gravitational equilibrium directly affect where and how a Wh can form. The very existence of the stargate network is the proof that we can influence the apparition of a WH. Some technologies like the drifters stabilisations structures, the Jumpgate modules and others are a proof that it is feasible, and only a matter of energy (physician joke here).

The publication of the FLEX’s series from UPWELL is another proof that the technology already exist.

The problem with such structures and modules are the physical limitations of the fuel used: the Liquid Ozone. Even with huge quantity of fuel, there is a maximum energy that we can generate at a time.

And that’s the exact reason why we can’t go any further than a few lightyears away.

Of course, with more potent energy source, we could probably reach much further. Even restart the expansion of new eden’s stargate network.

I suppose that CONCORD already have enough problem as it is to not launch a new “gold rush” toward foreign regions.

The “warp” is simply a variation of the tensor where, by using energy, we modify the “mass” around us, “sliding” on the tensor much like you would slide on ice and be slow on concrete.

So, why the connections don’t last forever once open?

The answer is simple: the very existence of this connection allow the gravitational waves of new eden and anoikis to pass through, slowly breaking the stability that allowed the connection to be made in the first place.

One more interesting thing to note on the data collected is that the only out of range statistic is the Average closed time. As we saw earlier, in theory, a harmony point alone isn’t always enough to form a connexion (that’s why a stargate is a two way process, opening a WH with only one stargate would be too costly in energy) yet, since the start of this year, the average time between the formation of an harmony point inside our WH and it’s connexion with new eden have dramatically shortened.

We’ll see in the next part my theory on the “why”.

## Part 4: Extra-System Gravitational Analysis & Abyssal Space

If the reason behind the change in time before the connexion is established isn't something due to the anoikis cluster. The data would have changed on the other measures (disparity, distance from barycentre, but the changes are not big enough to explain the change of behaviour alone.

If it's not from the anoikis' end, then it can only mean the change happened in new eden's cluster.

The thing is, no carolina's star or seylin incident's type event happened recently. It could be a new gravitational source that started emitting for the first time, the solution is my favourite because it don't involve complex mechanism or influence, the thing is, for such event to have a noticeable effect on the cluster, the energy needed would mean the whole cluster is aware of it and/or it is visible way before l'ts effect starts to take hold.

So it's possible for this change to come from the formation of a super massive blackhole or other cosmic phenomenon.

I'm not going to go around the pot any longer, The only reliable explanation I see for such changes in the fluctuation of new eden is coming from the abyss.

Pr Mayor showed in his analysis that the abyss was a gravitation maelstrom, a place not so different from the more common deadspace.

I'm not going to set the equation from earlier, but it's the same principle: some places have a tensor node "denser" than the usual "background" density.

That mean our navigational computers are not able to open a stable tunnel to the destination. On the same principle of an interdiction sphere, it creates a "drag" that prevent the ship to go through.

Those pockets are small enough to not be of any inconvenience in the day-to-day life but when trying to get to the exact location, it won't work, and you need to use a gravitational catapult: an acceleration gate.

Now, here is the interesting thing: an acceleration gate don't open a warp tunnel, it simply "push" you to a lower energy/mass ratio which is low enough to allow you to enter pseudo warp speed and reach the bubble until the drag is too strong and bring you back to sub-warp speed.

That's why some acceleration gates have, like wormholes, mass restrictions.



### Chaotic Gamma Filament

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Description Attributes

This Abyssal Filament will pull a **Tech I or Tech II Cruiser** into a pocket of Abyssal Deadspace experiencing **chaotic and destabilizing effects**, and bathed in the radioactive afterglow of a gamma-ray burst that will **reduce explosive resistance** but **enhance ship shield strength**.

**Warning:** Abyssal Deadspace is a particularly harsh and unforgiving environment. Entanglement of the warp core with a space-time filament introduces severe deformations of the ship's warp field that cumulatively increase over time. After **20 minutes** catastrophic collapse of the warp field is predicted, with **destruction of the ship and capsule** certain.

A device of Triglavian design that functions as one end of an energetically inert filament of space-time connected to a specific pocket of Abyssal Deadspace. When activated by a ship equipped with a warp core that has the correct mass-energy parameters, the filament becomes a conduit that will draw the activating vessel along it and into the connected deadspace pocket.

The mass-energy exchange involved leaves a highly energetic trace at the ship's origin point and the space-time filament remains entangled with the warp core of the ship that uses it. Triglavian Transfer Conduits will permit such a ship to progress through the deadspace pocket but an Origin Conduit will return the ship to its starting location in normal space.

Simply because the targeted deadspace isn't stable enough to let some mass pass without damage.

And we are getting closer to the Abyss.

Let's take a look at the filaments and how they work: they alter the warp core to open a conduit that lead to a specific part of the abyss.

To take a parallel, it's like activating a bridge on a cyno.

And "the mass-energy exchange leaves a highly energetic trace".

That's because the sudden activation of this "bridge" unbalance the space time tensor and create what could be simplified as a "gravitational seismic tremor".

Based on Pr mayor work, my hypothesis is that abyssal deadspace is a place where the tensor is so high (dense) that it cannot be reached from the outside without an enormous amount of energy. Making it almost impossible to detect.

What do we know of the discovery of the abyss?

It seems the first to have reached the abyss are either the rogue drones or the drifter. Whatever the case, it's by the drifter we learned about it, or, to be more exact, that the triglavians left messages for us, letting the drifter being the carrier. We also now that the rogue drones probably reached the abyss by looking for Isogen-5 and/or Isogen-10.

Then we got access to filaments. That mean we are not the one opening the way, the collective is letting us in. It may be an evidence, but it is an important thing to say: we didn't initiate the jump, we only crossed the bridge.

Why am I focusing on that?

Because it mean that by passing the barrier between abyssal deadspace and K-space, much more like when a Wh open and the gravitation waves of anoikis and new eden enter in contact, provoking the slow decay of the connection, the GW of abyssal deadspace come into K space.

But unlike anoikis and new eden, where the tensor is pretty much at the same level, with the abyss, the tensor is much more "stressed" and therefore have a stronger influence on the gravitational balance of new eden.

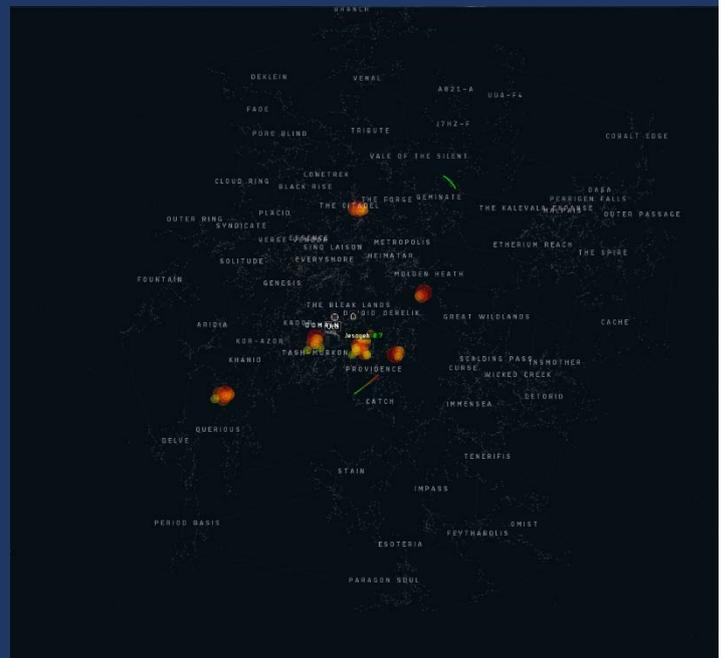
That is simply verifiable when looking at a map of the invasions.

Before the actual invasions of K space, the distribution of Wh connections were even, connecting to all core regions equally.

But since the start of apparition of filaments, and after that, of the invasions, the distribution radically changed to mainly connect to Amarr's and Jitta's proximity.

We are at the start of those effects at a cosmic scale, that's why it seem, for now, to have "stabilized" the path between those regions. But it's the same as being happy about the wind increase for the turbines when a storm approaches: yes, but no.

But what does that mean on practical terms?



## Part 5: Hypothesis

This part is purely theoretical and would need more funds than we have access to. But Here are my hypothesis, based on what we know, our observations and my ideas It's what I consider as plausible, contrary to the conclusion where I let my thoughts run a little wilder.

### 1) Abyssal deadspace and Anoikis

I think that by destabilizing the gravitational structure of new eden (and therefore Anoikis) there will be many impacts on the life of new eden: on the short term, we will see an increasingly connection inter and intra cluster. It seems like it's already happening, reports from all my contacts in Anoikis stating that the number of roaming Connections has risen.

On the long run though, the global number of connections between the two cluster could dramatically decrease, cutting off the two cluster because the harmony point can no longer connect to each other's (imagine the "bubbles" we talk earlier being too small to touch another one)

### 2) Triglavian invasions & star gates

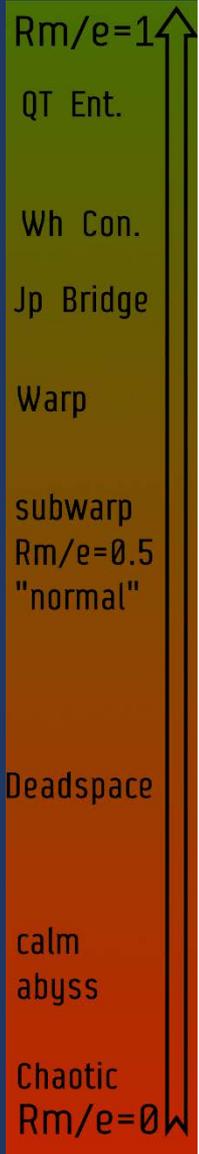
With more and more breach being made by the triglavians, the cluster could be at risk to see a huge problem appear: star gates could locally stop working.

As I said on the last point, if the harmony points can't contact each other's, the stargates won't be able to open a stable connexion, forcing the isolated system to rely on more energy demanding systems to keep contact.

If you push the logic to the end, it could theoretically mean that a quantum entanglement link can be broken. That would mean no communications, no infomorph transfer and no clone activation on death.

### 3) Seylin incident & Sleepers

Given the odd specificity of the seylin incident it could be possible that it was made to compensate the abyssal pression on the gravitation tensor, it would explain why Connections with Anoikis started right after this event, by making the cluster much more stable, it allowed the connections to be made on a regular and usable manners.



## Conclusion

Here I'm not going to rephrase what I said, but rather leave the field of "possible" to reach the fields of "what if"...

In this conclusion, it no longer represents the work of hundreds of scientists and experts, the millions of people that made this study possible. I can't thank enough the Khazad Consortium to have made possible this experience.

It represents my ideas only, for what they are worth and I do hope they only are the crystallization of my worried mind.

But here is my train of thoughts:

We know that the connexion between Anoikis and new eden was common in a distant past. It's a fact.

We know that the Talocan suffered some kind of contamination.

We know that the Talocan, sleepers, drifters, joves and finally us, all use compatible materials that are nanites-based.

So here is my fear:

What if the Triglavians were purposely kept from coming in K space? The fact that explosions happened both in new eden AND anoikis lead me to think that it was planned a long time ago.

But then, if the joves and sleepers had the power to connect Anoikis and new eden once more, why not doing it before?

Maybe simply because the connexion wasn't the goal. What if the stability of the cluster was this goal?

The only other thing a stabilizing event like the Seylin incident would do is render much harder the connexion to the other side of the spectrum: the abyss...

And the apparent war between drifters and triglavians seem to corroborate this.

But I want to address a last piece of information's.

We also know that the Triglavian use mutaplasmid to mutate those nanites, changing their use.

What if the contamination reported by the Talocan wasn't a biological one, but a mechanical one: the mutaplasמידs.

By making new eden less stable on the gravitation side of things, the Collective is also increasing the mutaplasמיד tolerance to our space. And by that, I mean it could affect larger, bigger and more complex forms of nanites assemblies.

Like stations or whole colonies.

I hope I'm wrong, but when you put all the pieces together, the path will be difficult.

There is simply too much coincidence for it to be only luck.

Umbre Fallenstars.