THE HYPERSPATIAL DIMENSION

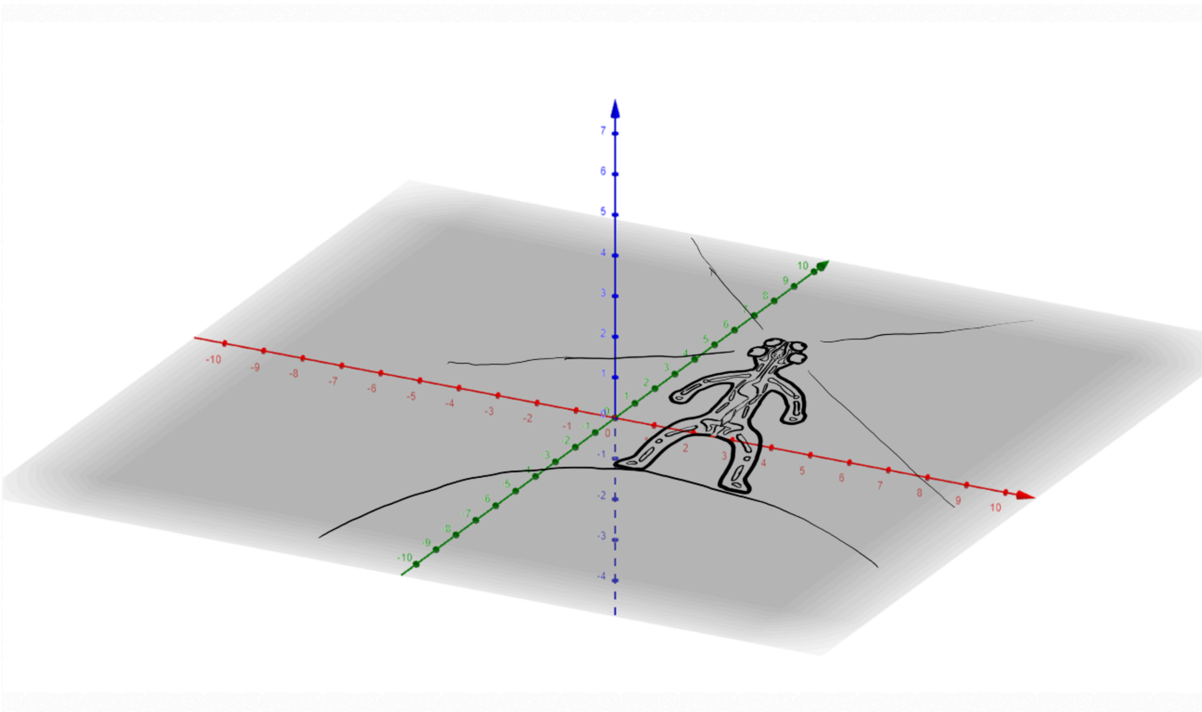
A BEGINNER'S GUIDE

1-INTRODUCTION FOR THE UNINITIATED

This document is a surface-level guide to understanding the nature of the 4th dimension (colloquially known as hyperspace). Let us begin with the basics.

For someone that doesn’t know better, our universe has 3 dimensions of space and 1 of time. However, as is usually the case, the truth is not that simple.
Our universe actually has 4 dimensions of space. However, the 4th dimension, which we will call *hyperspace* from now on, is different from the other 3 in a few key ways that help conceal it, in a sense.

First, let’s begin by simply conceptualising a so-called 4th dimension.
If we lived in a 2D universe with a third hyperspatial dimension, it would look something like this from the point of view of a 3D observer:



1.1- *A 2D creature enjoying an evening on their favourite hill.*

The green and red axis are the normal spatial dimensions, while the blue axis is hyperspace.

The 2D creature, who we will call Flatty, does not know about the existence of the blue axis, because they have evolved (much like us) in a universe where hyperspace is not easily accessible, and therefore no prey or predators lurk there.

In fact, in Flatty’s universe, the entirety of hyperspace is mostly empty, with 99.999923 of all matter concentrated exactly in a flat plane at z=0 (z being the blue axis). As you might have guessed, this is also the case for our 3D universe - just a lot harder to graph out.

So to summarise, Flatty’s universe is actually a 3D universe, where the 3rd dimension is very but not completely inaccessible to matter. The resistance that matter meets when travelling up or down the z-axis is very important - it is what keeps Flatty from realising his universe is not actually 2D, but rather 3D.

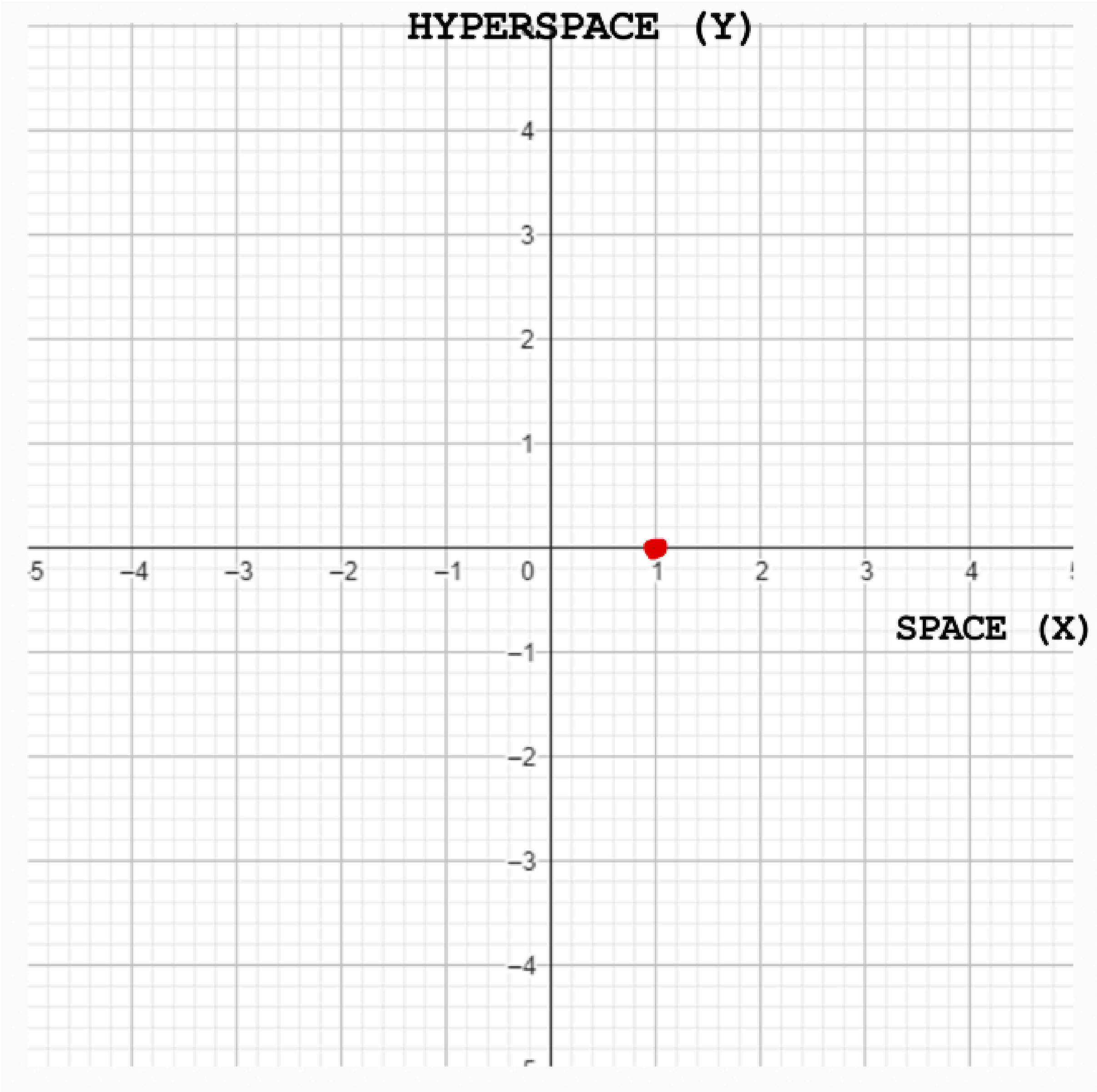
Having understood this, we now know that *our* universe is 4D, and that the 4th dimension is very hard for matter to move through - and therefore, we have evolved to only fit 3D spaces in our minds.
Finally, we understand that what separates hyperspace from regular space is that hyperspace has *resistance* to matter moving through it - hyperspace wants you to stay at z=0 and will fight you every step of the way if you decide to traverse it.
This important phenomenon is called Hyperspatial Buoyancy (HSB), and we will talk about it more in the next chapter.

2-DIVING INTO HYPERSPACE

i) Simple movement on the hyperspatial axis and HSB

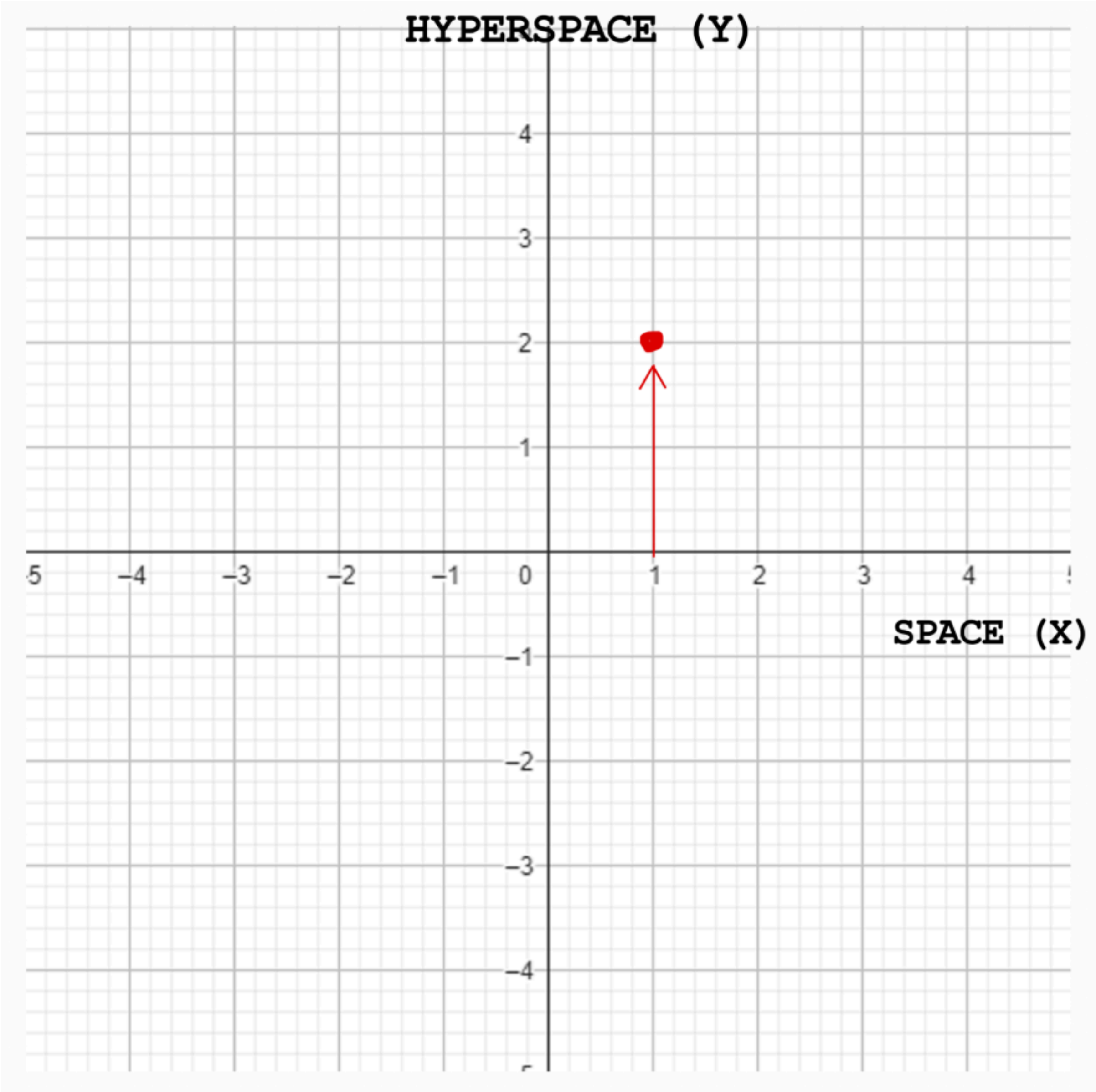
Let's take a look at an even simpler diagram - that of a 1D universe.

2.1



2.1- *An empty 1D universe, with a single red atom hanging out at (1,0)*

An atom exists in this universe, and it is able to freely move on the x axis. But what happens when we give it a vertical push, forcing it to climb the hyperspatial Y axis?



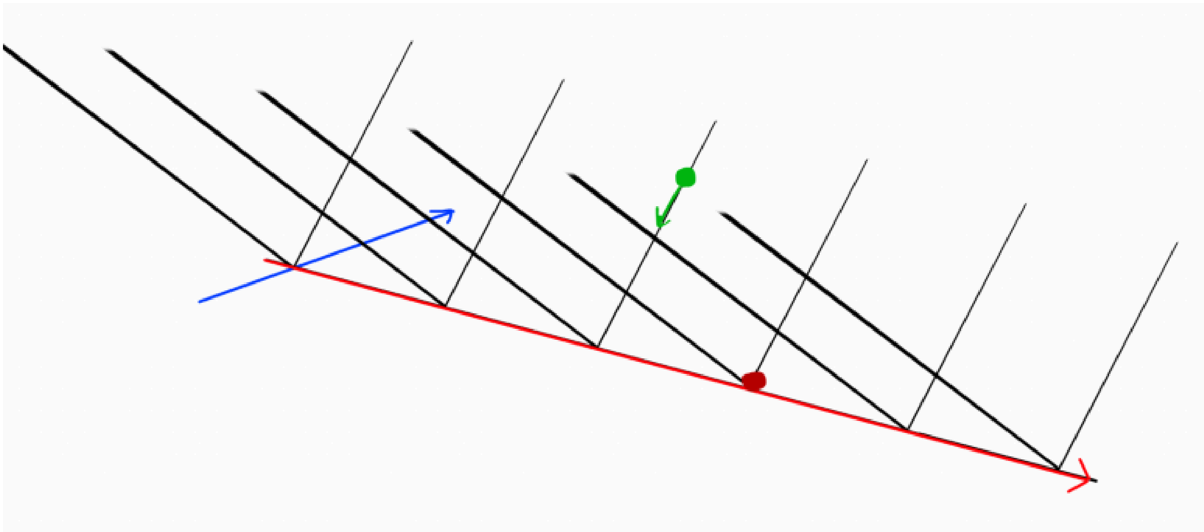
***2.2-** Our red hero ascends the Y axis.*

Rather unsurprisingly, the atom “jumps”. However, the higher on the y axis the atom is, the greater the resistance pushing it back towards y=0. It feels a bit like pushing a volleyball down in the ocean - because of buoyancy, the deeper you go, the stronger the upwards push.

This atom, when we stop pushing it up, will “fall” back towards y=0. Then, it will oscillate on the y axis for a while, until it slowly comes to rest at y=0. The same would be true if we pushed the atom down, towards the negative values of the y axis.

We call this phenomenon HSB, or hyperspatial buoyancy. HSB hates it when matter travels hyperspace (away from y=0, in this case), and will try to hold all matter in the universe firmly at y=0.
HSB is what sets hyperspace apart from regular space, and while it's a bit boring, it is essential that we grasp HSB firmly by the balls to create a solid foundation.

Here's another handy way to visualise HSB in the same 1D universe:



2.3- *A "valley universe" diagram.*

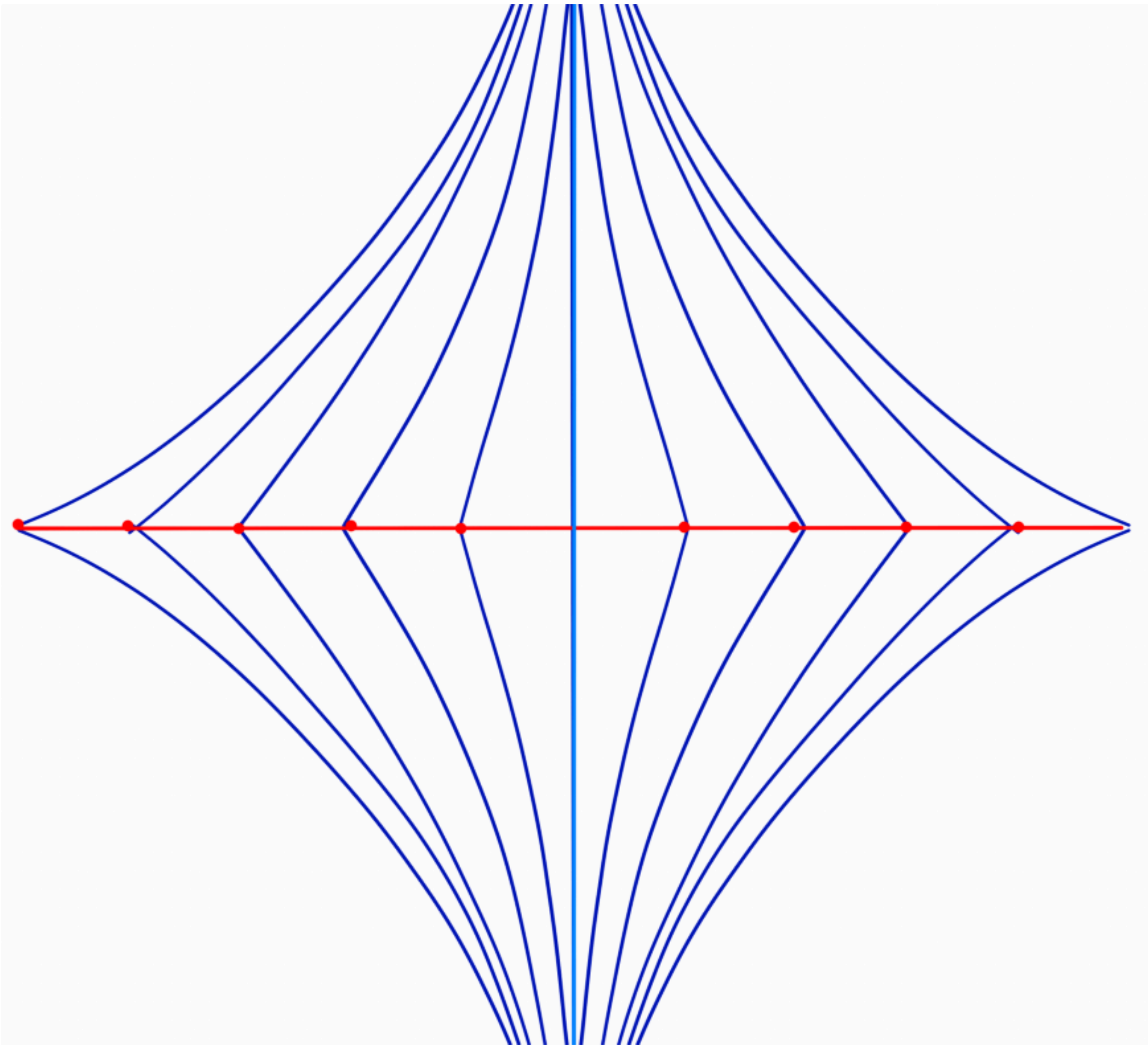
In this diagram, the red axis is space (X) and the blue is hyperspace (y). However, to visualise how all matter ends up at y=0, we have added some sloped cliffs that go up in either hyperspatial direction. Particles that move on the y axis away from 0 have to "climb" these slopes, and in due time will always rest at the lowest point, which in this case is y=0.

Next, we are going to take a look at what *causes* HSB. I swear, we are getting to all the fun stuff after this bit.

ii)The hidden mechanics of HSB

HSB is actually caused by an underlying law called Frame Shrinkage. As you move up the hyperspatial axis, *space itself gets smaller.*

This is obviously a bit unintuitive, but that's nothing that a good graph can't fix. Observe:

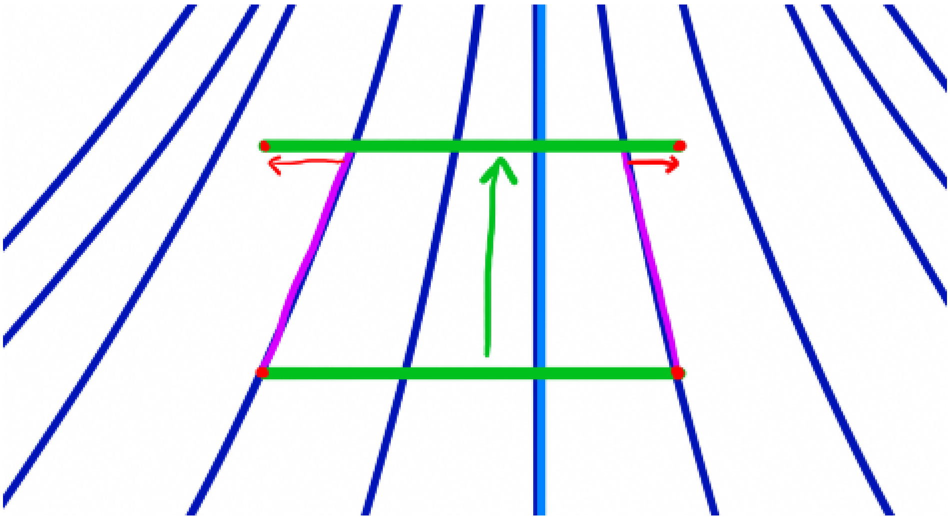


2.4- *A Frame Shrinkage diagram*

In the above diagram, the horizontal axis is space and the vertical is hyperspace.
The converging dark blue lines are fixed points in space (geometrically, they are geodesics). An object with no exterior forces acting upon it will always follow these lines as it freefalls towards y=0.
As we can see in the diagram, the higher in hyperspace you go, the "tighter" space gets.

“But how does space shrinking create all these downward-pointing forces?” I hear you ask. Actually, Frame Shrinkage resists you in 2 discreet ways. Allow me to demonstrate:

a) Velocity-Induced Explosive Resistance (VIER)



2.5- *A green object experiencing the VIER effect*

In the above child’s drawing, we see a green object of some length moving away from y=0 in hyperspace.

As we said before, objects falling in HS want to follow the dark blue lines. However, because the green object has a set length, we can see that its red tips (and subsequently every other piece of the object other than its core) *don’t* follow the path they would naturally take.

As shown by the red arrows, the tips of the object find themselves *further apart* than they would be if they were freefalling. This manifests itself as an outward pressure - an object going fast enough into hyperspace will explode as all its component bits are ripped apart by VIER!

However, besides the cool explosions, VIER has one more very important effect. The energy needed for the object to feel this explosive pressure has to come from somewhere - and that somewhere is the object’s kinetic energy.

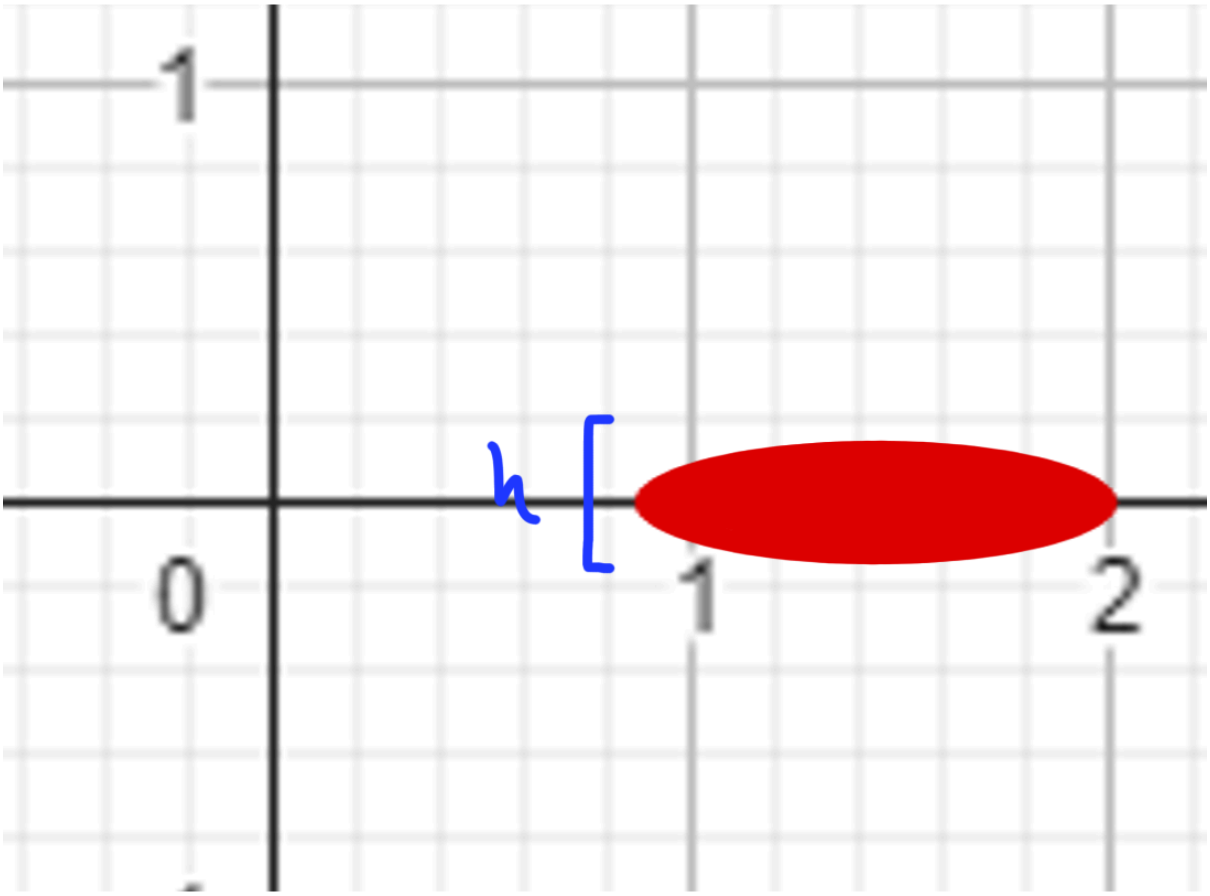
If the object is moving towards y=0, it will experience an inward, implosive pressure instead, and it will yet again be sapped of its kinetic energy.

This means that hyperspace has a natural resistance to velocities aligned with the y axis, and will resist objects moving faster more.

After VIER has done its thing and consumed all of the object’s kinetic energy, the object now finds itself stranded somewhere in hyperspace. That’s where the second force comes in.

b) Matter-height Buoyancy

Firstly, it is important to understand that even in this 1D universe, all matter has an infinitesimal “height” in the y axis.



2.6-*Crude facsimille of a 1D particle.*

Notice that in the image, the theoretically completely flat particle has a small but noticeable height h.

Because of that height, a pressure differential is introduced. There is just a bit more pressure from Frame Shrinkage at the top of the particle than at the bottom of the particle. This gives our particle a gentle acceleration towards y=0 (the particle will reach a small terminal velocity as VIER kicks in and reaches an equilibrium with the buoyancy).

Both of these forces combine into the infamous HSB and are needed to keep the world as we know it. If VIER was gone, particles would get caught into infinite oscillation on the y axis because their velocity would never be drained, and if matter-height buoyancy was gone particles would get stuck in hyperspace and stay there.

And with that, congratulations! You have finally completed your understanding of HSB, and you know how to move through hyperspace. Now we can do some fun experiments.

3-ADVANCED MANOEUVRES

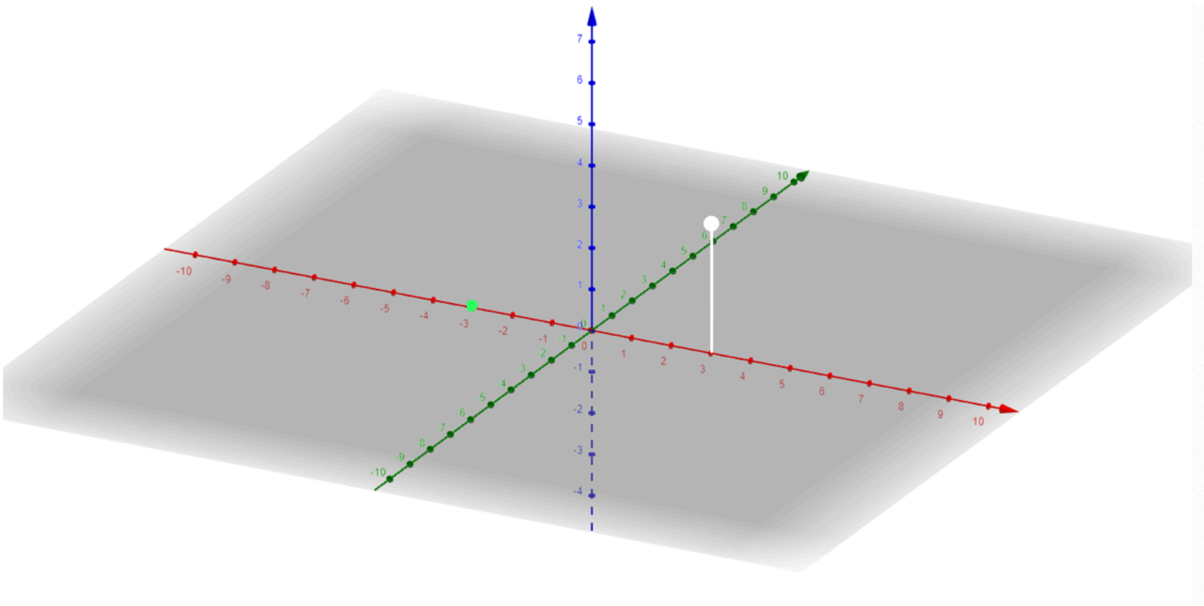
Now that you have a basic foundation, it's time to start looking at some more advanced (and fun!) experiments.

i)Points Of Light & Projections

The most interesting thing we can answer about hyperspace is, *what the hell does it look like?*
To answer that, we need to figure out how light works in hyperspace. So:

What would you see if there was a single point of light above you in hyperspace?

Let’s answer it. Firstly, our trusty diagram of Flatty’s universe.

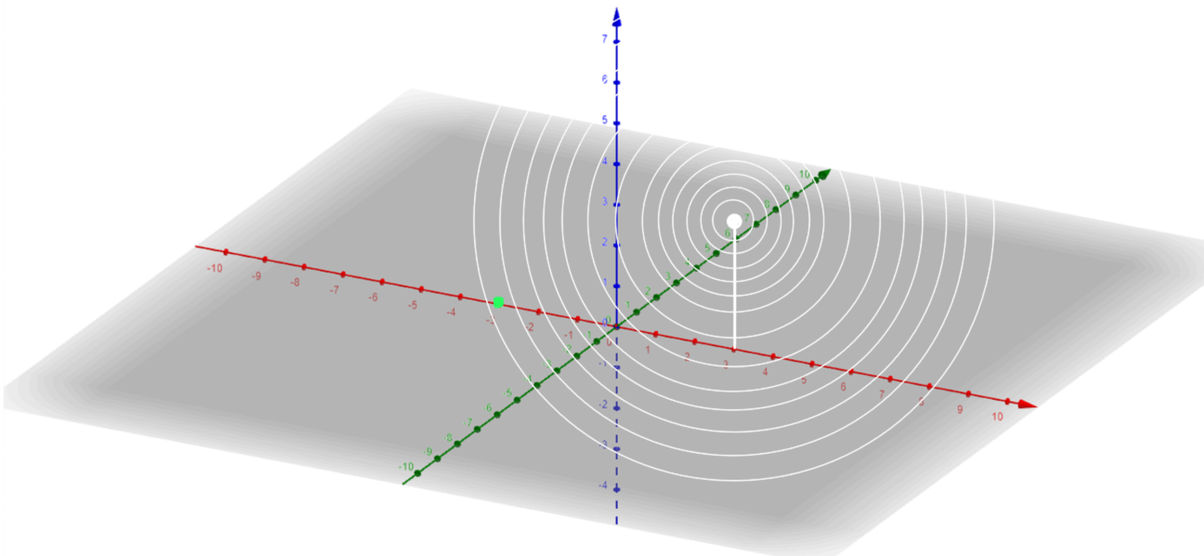


3.1

In this diagram, there is a green observer and a white point of light sitting above the observer in hyperspace.
Normally, the observer can see everything that is in his 2D universe - meaning everything on the plane he sits on.

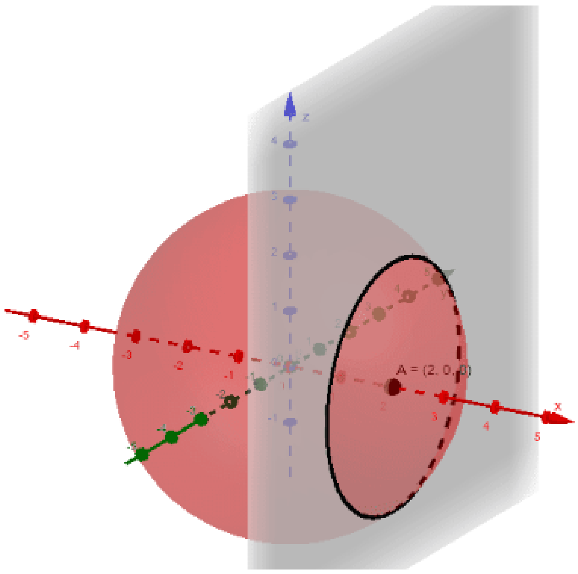
Some would say that because the light source is above him, he simply won’t see it. After all, he can’t even mentally visualise the third dimension. However, this is not the case.

Light travels through hyperspace as if it were normal space, unhindered by all the resistances that regular matter has to contend with, because it is massless. Therefore, the light source in 3.1 would emit light much like a regular 3D light source in our world: In concentric spheres away from the source.



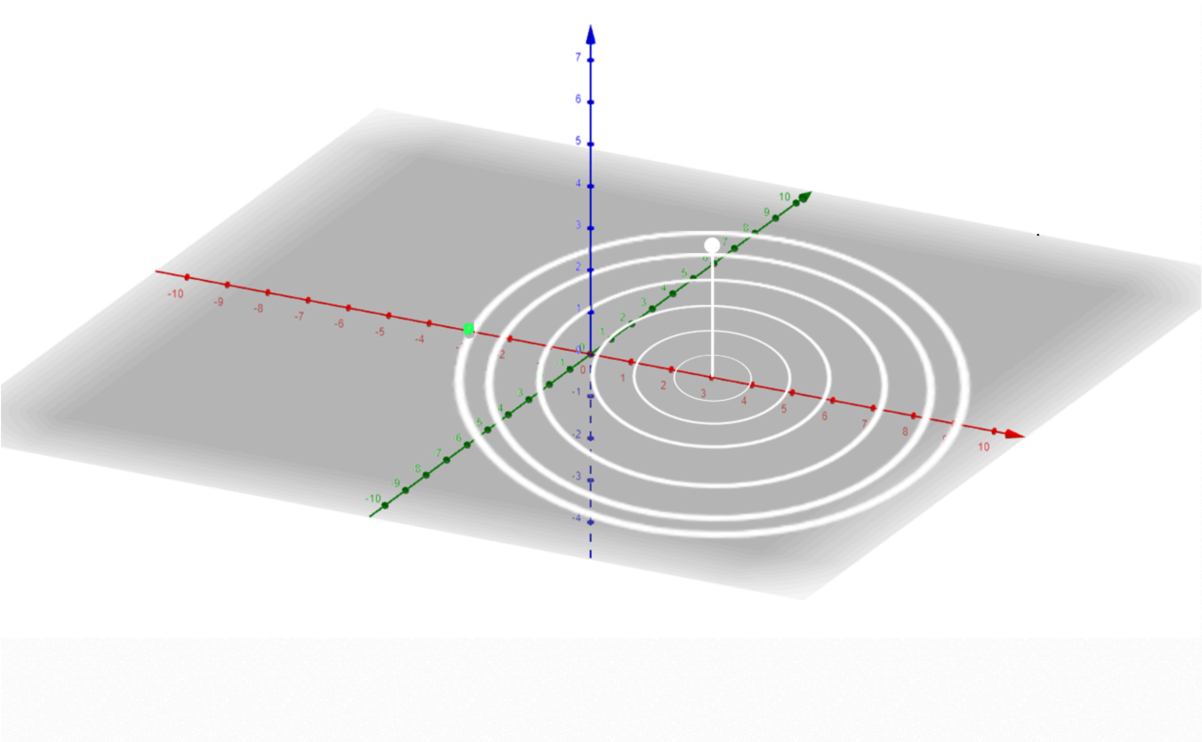
3.2

That still doesn't really tell us what our green observer is supposed to be seeing, however. That is, until we realise that when a plane intersects a sphere at ANY angle, a circle is formed!



3.3

And when we take into account that a single pulse of light is a sphere that starts with a radius of 0 at the source and grows outwards until it intersects the 2D universe's plane, we realise that the 2D universe only sees a set of concentric *circles instead of spheres,* growing out from a point directly below the point of light.



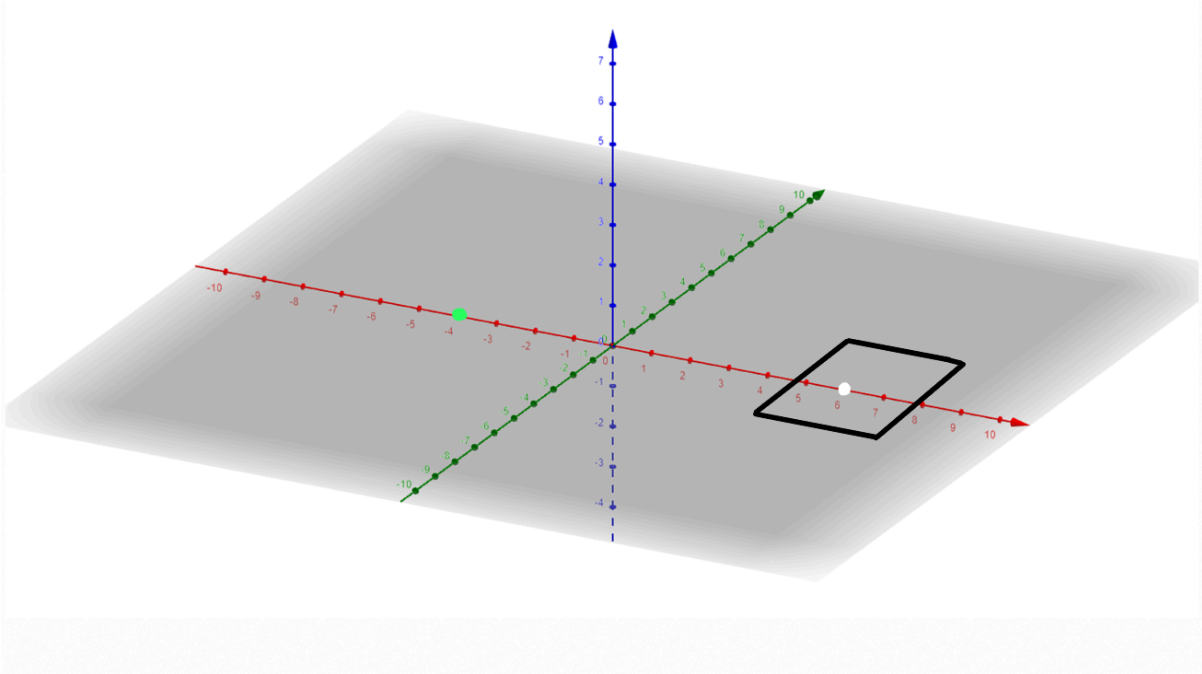
3.4- *Bingo! Our observer detects light.*

From the above diagram, we can see that our observer will see a *projection* of the hyperspace-displaced light source, directly below the real light source.

For our 3D world, this means that we would see a light source that has been displaced in hyperspace as a ghostlight - a light without a source! You could even walk through the light as if it weren't there.

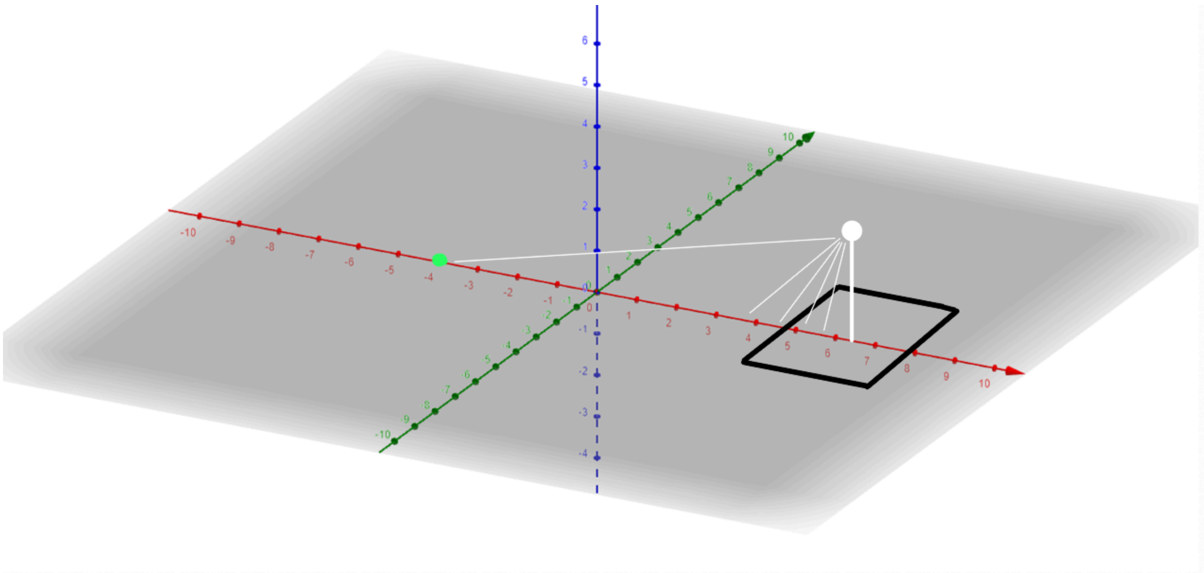
But wait! There's even freakier phenomena on the horizon.

This time, let's build a box to put the light in.



3.5- *We locked his light in a safe.*

From 3.5, it is obvious that the observer cannot see the light, because it is sealed inside a completely opaque box. But what if the light was displaced?



3.6

Inconceivable! Even though his light is safely tucked away in a box, because of the light's hyperspatial displacement, light rays can simply go *over* the walls. This means that a displaced object's projection will *always be visible*, even through walls! In the real world, that means that the displaced object's projection would appear overlaying everything else, like it is being rendered in a separate layer than the rest of the world (Think of wallhacks in videogames - the effect is very similar).

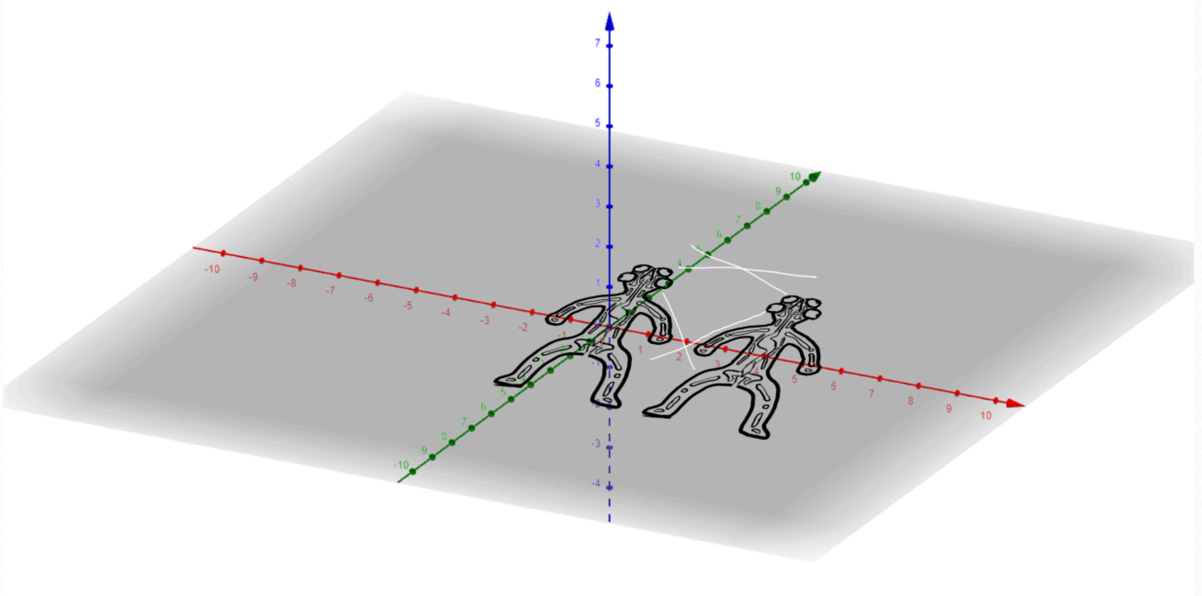
ii) Real Objects in hyperspace

Now this is what you have been waiting for. We are all Real Objects, and we all want to go to hyperspace to see what it's all about. So what do we, the brave hyperspacestronauts see, and what do our craven friends who stay behind see?

a) The Panopticon Effect

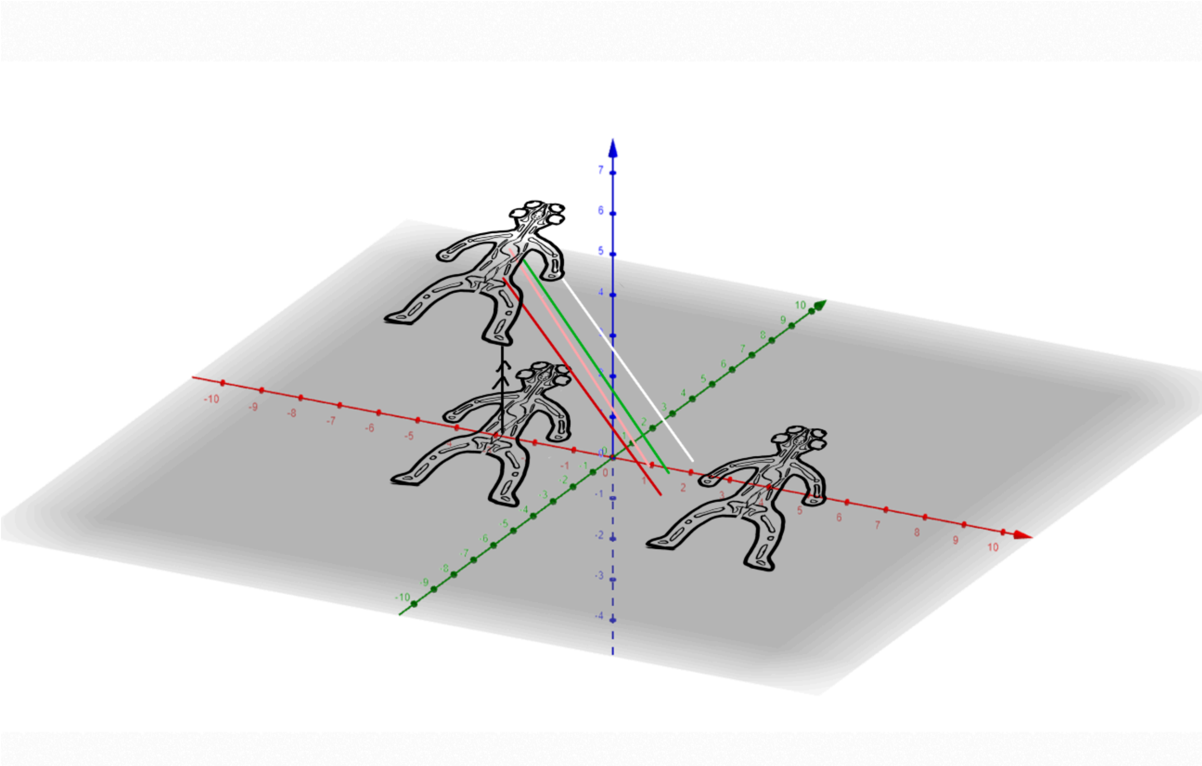
We enter hyperspace next to our friend, who stays behind. What does our projection look like?

Because of the Panopticon Effect, we appear entirely translucent. Our friend can see through our clothes, skin, organs, and bones. How does this happen?
Let's ask Flatty for help.



3.7- *Flatty and his close friend, dr. Bamboleri*

We ask Flatty to perform the same experiment. Flatty will go into hyperspace and his friend, dr. Bamboleri, will observe.



3.8- *A gruesome sight! Flatty's internals are visible to dr. Bamboleri.*

As we can see above, because Flatty's physical body can no longer "block" its own internal lines of sight, all of Flatty's innards are now visible to the doctor (including his weanus).
This is basically the same effect as the light point being visible through the box from 3.6, but more complex. In fact, Flatty's projection will also be seen through walls and any physical barriers.

In real life, our friends see us as disturbing, completely translucent ghosts that you can see through walls. Here's a visual aid:

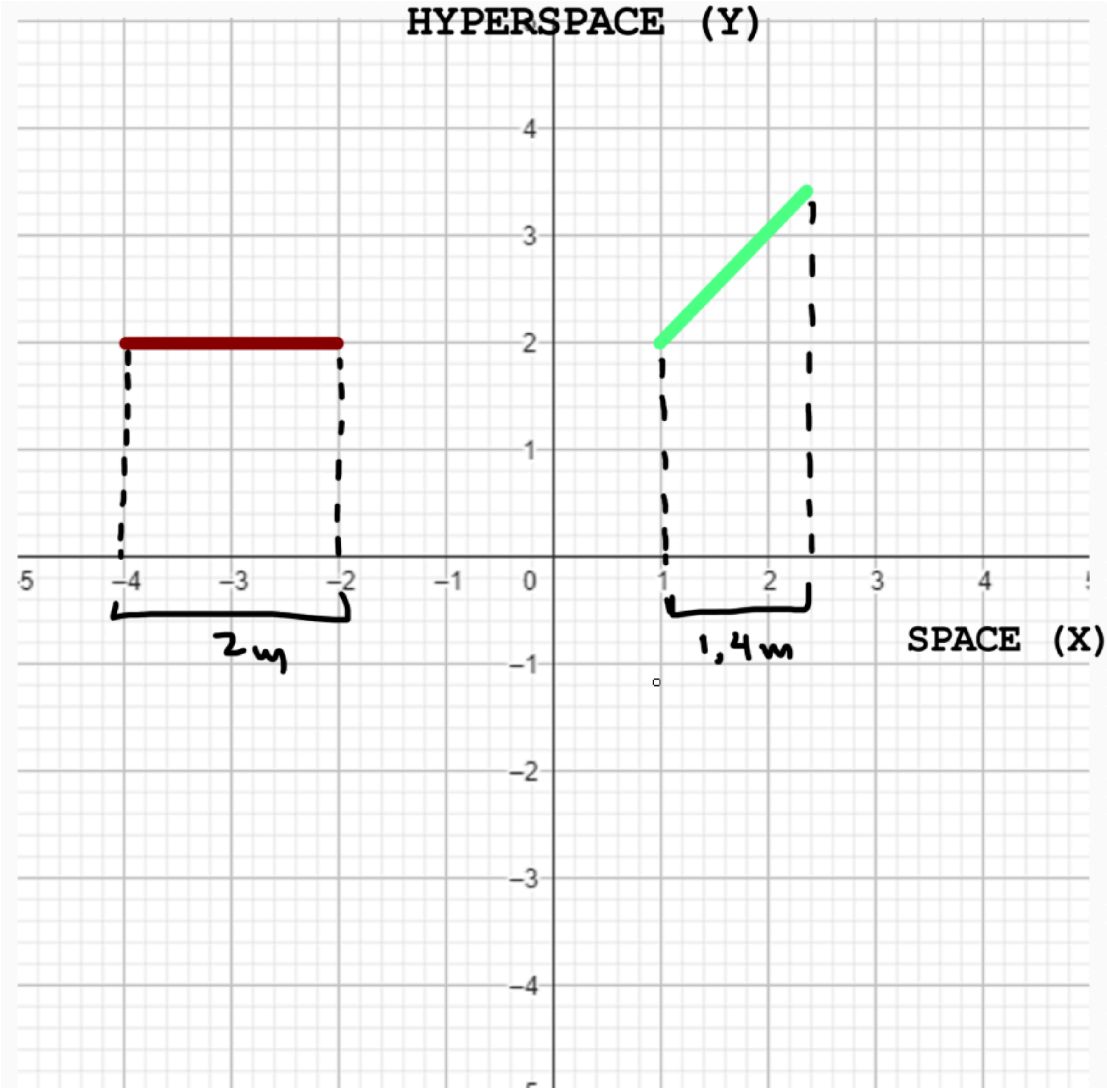
3.9- *A person (left) vs a hyperspace displaced person (right)*

Notice how in this crude drawing all black elements disappear, while all white elements come forward. This is because the projection is *only* light, with no physical presence, and as such colours that are dark and use light absorption rather than reflection to be seen, vanish.
Think of your reflection on a window - because there is light coming to you from behind the window, your reflection is "overlaid" over whatever is outside, and black/darker colours are suppressed in favour of lighter ones.

The Panopticon Effect also works in reverse. When you enter hyperspace, you see the entire world as a projection - which means you can see through everything, including the entire planet.

b)Rotational Distortion

Besides moving up and down through hyperspace, objects can also rotate using it. What does this look like?



3.10

Both the red and green objects are the same length. However, the green object has been rotated in the hyperspatial dimension by some degrees.
As we can see in the graph, the green object will appear "squished".
In fact, we can flip the green object entirely around, and it will come back to its universe a mirror image of what it was before!

In real life, as you begin to rotate in the hyperspatial dimension, your projection will appear flatter and flatter, like somebody is badly editing your image. When your angle is 90 degrees, the projection will be a 2D image, and as you continue rotating, you will have flipped to your mirror version - The words on your shirt are backwards, you are now left handed, and so on.

3.11- *Professional Man performing a businesslike hyperspatial rotation.*

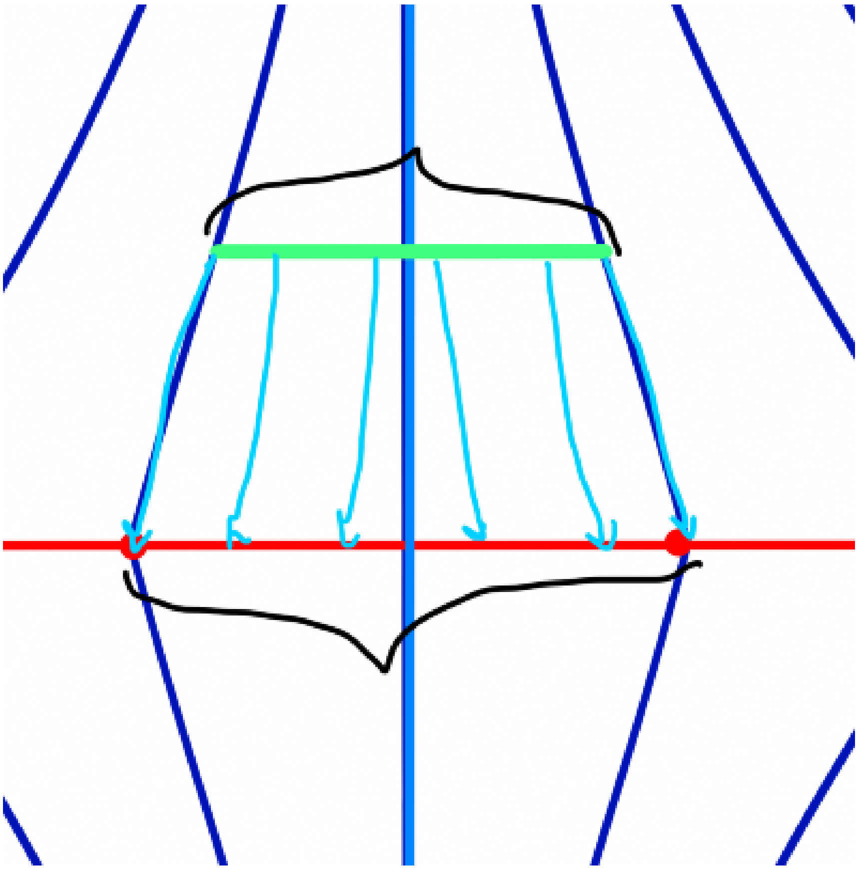
This can work on any of your 3 axis - that one will be flattened as you trade it in for the 4th dimension, and the rest will remain as they are.
Also of note is that you cannot *stretch* your projection, only squish it.

c) Distance Fading

This is probably the simplest effect so far - The further away you get from something in the hyperspatial dimension, the fainter your projection becomes as your light gets spread over a larger area. Eventually, your projection becomes too faint to be seen by the naked eye, but it never completely disappears.

d) FS Lensing

If we take frame shrinkage into account, the projection of an object appears slightly larger than the actual object.

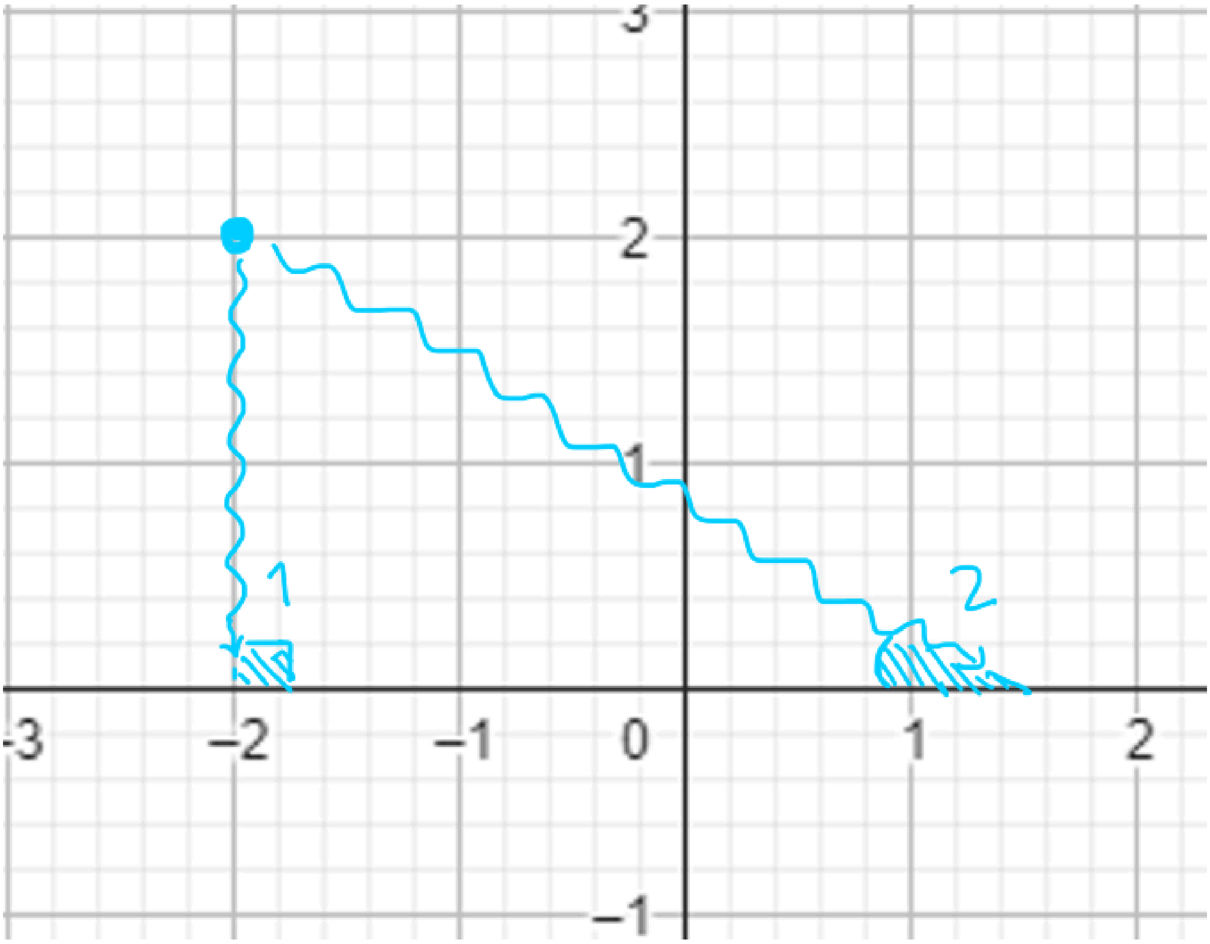


3.12

However, by the time an object is deep enough in hyperspace to have a lensing effect large enough to be seen, it has already faded to the point it's invisible, so this phenomenon can only be measured with specialised instruments.

e) Photon Strike-Angle

Photons are more likely to interact with particles they "strike" if the hyperspatial angle of their approach is closer to flat.



3.13

Photon 1 has an angle of 90, which is the worst angle for interacting with particles. Most likely, photon 1 will simply pass through the universe.
Photon 2, however, has a sharper angle, which allows it to more easily interact, and therefore be seen.

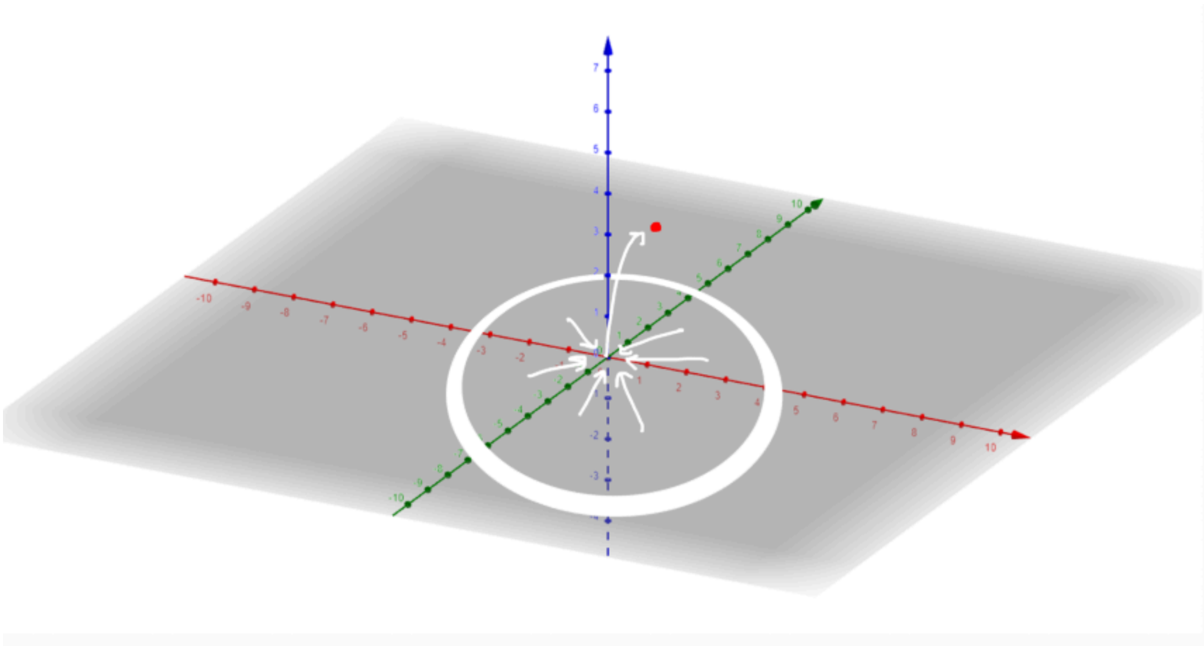
This means that the closer you get to a projection, the fainter it will get. If you stand in it, it will become invisible to you.
Similarly, if you are diving into hyperspace and looking at the projection of the world around you, you will always be sitting at the centre of a black sphere, and the rest of the universe will only be visible beyond that.

4-BEYOND THEORY

Now that we have a solid understanding of most of the mechanics of hyperspace, we can look at some natural phenomena, as well as get into the technical details of how to *actually* harness hyperspace properly.

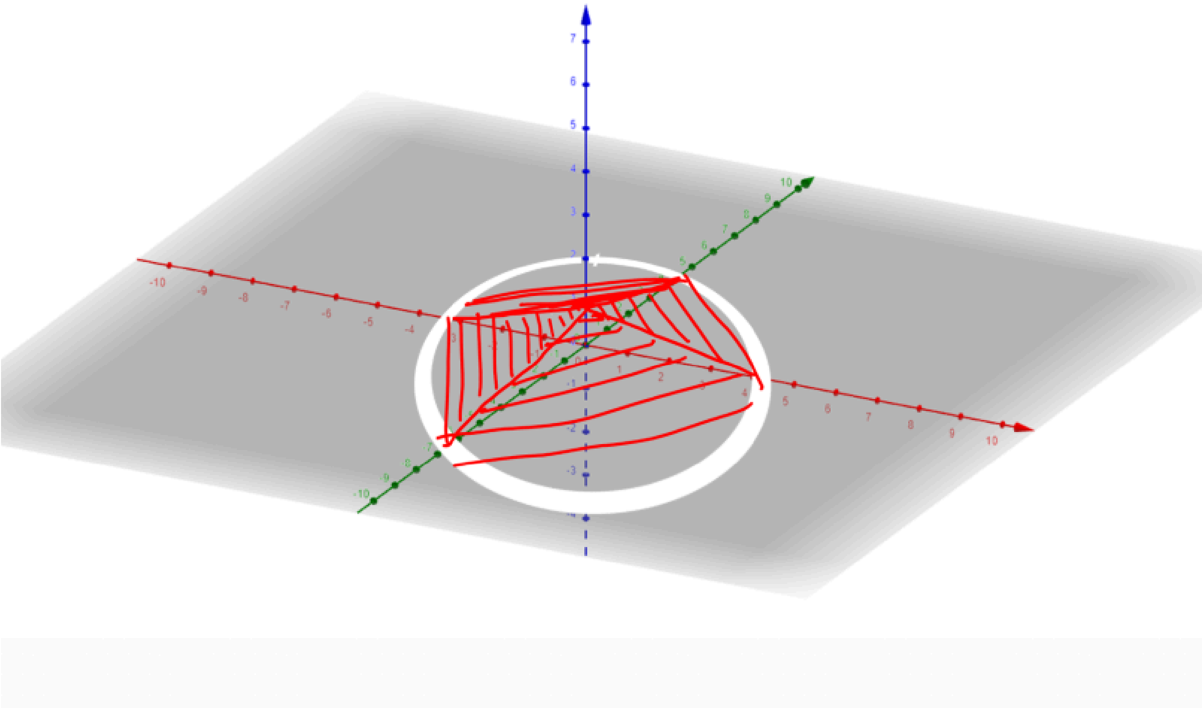
i)Naturally Occuring Hyperspatial Phenomena

Natural HS displacements of matter do occur naturally, at the cores of massive celestial objects. The massive pressure can sometimes eject matter into hyperspace.



4.1- *A 2D star ejects an atom into hyperspace*

As the star ejects more and more matter in both hyperspatial dimensions, the ejected matter becomes trapped above and below the star, as seen here:



4.2- *A pile of starmatter (represented as a pyramid due to poor graphing skills) stacked above the star in hyperspace. A similar stack is not pictured below the star.*

Because of this, an observer travelling up in hyperspace will see the stars and planets get smaller and smaller, vanishing in order of mass, until the sky is just projections.

The trapped matter still contributes to gravity, so the mass of celestial objects is relatively unaffected.

Black holes behave similarly, but instead of trapped matter which would be impossible, their hyperdimensional nature is simple: The region of spacetime that the event horizon encompasses is 4D, so black holes behave very much like regular hyperspheres.

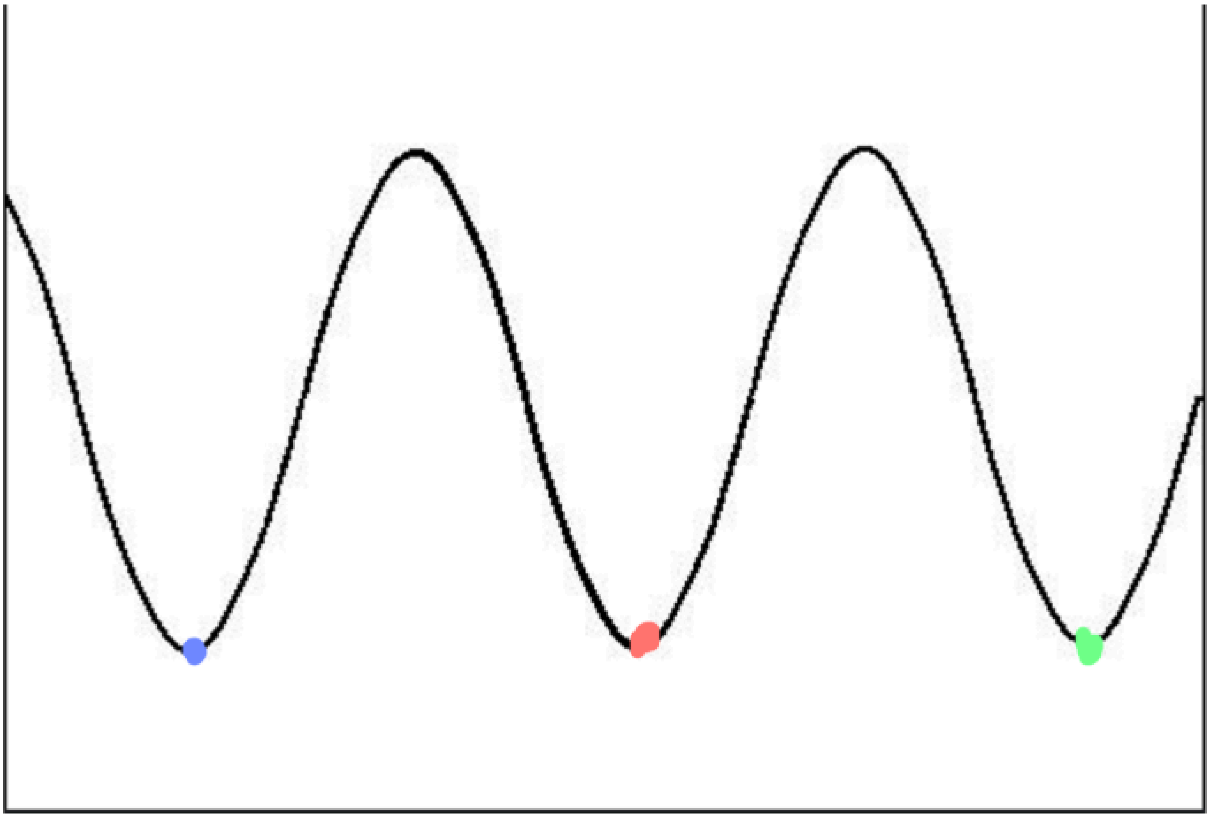
Finally, the correct amount of rotation in massive celestial objects will sometimes create favourable magnetic fields that will aid the pressure-ejected jets of particles, flinging them high enough into hyperspace to force them to “miss” their home star or black hole when they are coming back down. This results in so-called “oscillating cosmic hyperspace rays”, or OCHRA’s for short.

ii) The Hyperspatial Multiverse

It is all well and good to describe our universe as a valley between two mountains, but has anyone ever actually managed to scale those summits and descend the perilous cliffs of the other side?
Actually - yes. It would seem that our little valley universe is simply one in a series of thousands of similar valleys - and the number is constantly (and catastrophically) increasing. Allow me to demonstrate with a simple visual example:

4.3- *Pointlike valley universe.*

Assume the above pink dot is our universe (Compressed into a point for ease of use). On its left and right are the slopes of the hyperspatial "mountains" - they represent the increasing energy needed to actually move "up" in hyperspace. But what if I told you that wasn't the full picture? Let's zoom out.



4.4- *Three sequential valley universes, separated by hyperspatial peaks.*

Indeed, our universe has two neighbours! Both of them are separated from us by tall (but not unscalable) energy barriers.
All our neighbour universes follow the same laws of physics as us, and are filled with the same stuff as us - although about half of the total number of universes are dominated by antimatter rather than matter.

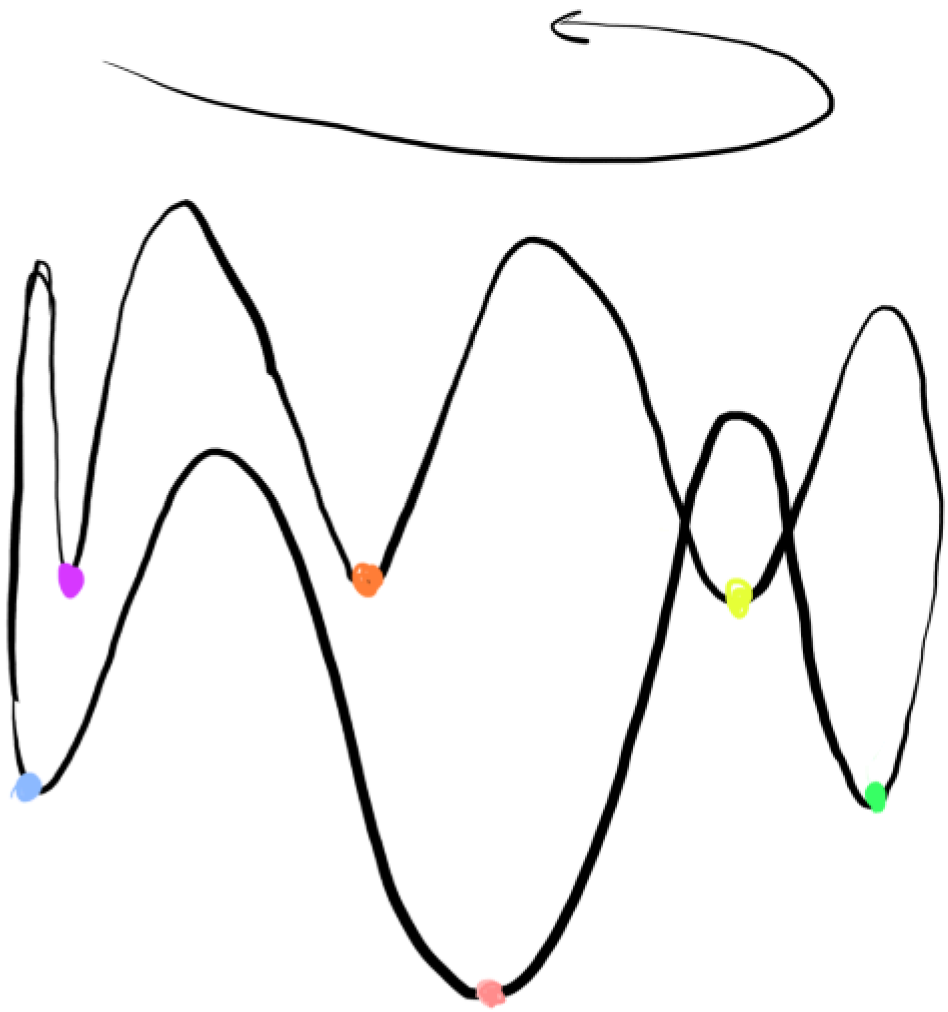
Looking at each universe, they all look very very similar to each other. They are all, including ours, mostly empty, with galaxy clusters and galaxies and stars. All of them unique, but also all of them very very similar, in the Grand Scheme of things.

"But how do we get there?" I can hear you asking. Well, near the peak of the mountain, the maths gets very fuzzy and complicated, so we won't get into the specifics - but the summit is mathematically (and now, practically) crossable. It just takes a hell of a lot of energy. Whether it's worth it is another matter entirely.

Now, let's get into some more specific geometries and mechanics of the Multiverse.

iii)Geometric History of the Hyperspatial Multiverse and Cataclysmic Harmonic Dichotomisis

Firstly, we have to establish one rule: The hyperspatial dimension is *closed*, or *looping*, geometrically speaking. To explain this, let's make a more accurate representation of the neighbour universe diagram from 4.4:



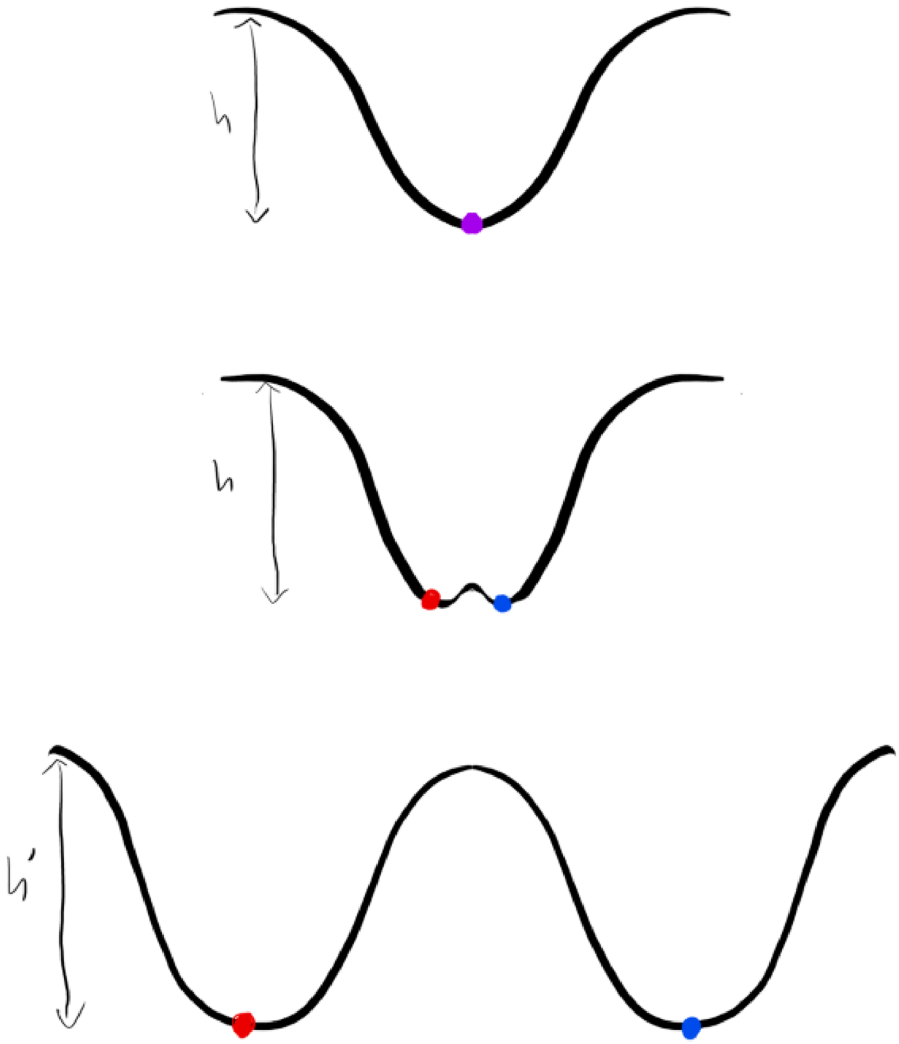
4.5- *A looped hyperspace valley-multiverse diagram.*

As we can see, hyperspace is now "looped". This means that if you keep heading "up" in hyperspace, you will eventually end up where you started. Effectively, this turns hyperspace into a ring with a finite number of valleys and peaks. This means that at any time there is necessarily a countable number of valley universes. With this established, let's get down to business.

As the universe grows older, more and more valley universes appear, due to the “slackening” of hyperspatial tension. This means that during the early epochs of the universe, there were a lot fewer valley universes - In fact, the formation of “valleys” in hyperspace started with just two sister valleys, one filled with most of the matter in the multiverse today, and one with most of the antimatter. Ever since, these sister universes have been splitting into more and more, further dividing their total mass, until we get to the many thousand-strong multiverse of today.

These earlier, much denser universes were fairly different to ours. Filled with orders of magnitude more matter, the skies were bright with supergalaxies filled with quintillions of megastars. Back then, the energy densities of certain areas were so high that spontaneous black hole formation was a real possibility!

So how and why does a valley universe “split”?
Firstly, let’s start with another diagram to illustrate the process for the visual readers.



4.6- *Visual representation of Cataclysmic Harmonic Dichotomisis, or "splitting"*

The purple universe contains mass M. Through a process that will be detailed later, a "spike" forms at the floor of the valley, equally splitting all the purple universe's mass into two separate universes, red and blue, each with mass m (where 2m=M). Also of note is that after a valley-universe splits, the total "height" of hyperspace (here h) is slightly reduced, as some of the tension stored in it is released.
During this process, dense objects (like stars and planets) will hold together and fall into one or the other universe whole, while sparser objects (like galaxies) will split in half mostly evenly and reform in each universe.

This event is, as the name implies, cataclysmic. Lower-density stars might be stirred enough to destroy themselves en masse, and most star systems are randomly halved, leaving stars without planets and planets without stars. Galaxies are also decimated and then have to recollapse.

As if that wasn't enough, the total height of hyperspace gets lower for each cataclysmic dichotomisis. This means that in the far future, after an near infinite amount of universal splits, hyperspace will be so "low" that matter will be free to travel it unimpeded. The multiverse will have now merged into one unified 4D spacetime.

So *why* do valley universes split?
It has to do with hyperspatial tension slackening over time. Through the various processes of entropy, hyperspace slowly loses its tension as it expands, lowering in total height. A random spike can occur through a bit of tension being released, but usually the spike is quickly recovered through the elasticity of hyperspace.
If that spike is at the wrong place, however (i.e. at the bottom of a valley) it will split that universe, and because the matter in that universe will fill the new, smaller valleys, it will not be able to recover itself like normal.

iv) The Summits of Hyperspace
The valleys of hyperspace are, as we discussed, filled with matter, energy, and, well, everything. But what about the summits? Are they simply barren barriers, only there to hinder visits to our neighbours?
Well, mostly. But not entirely. The only truly barren place is the slopes. The summits are in fact home to a few elusive modes of negative-mass exotic matter used in a variety of technologies. By its nature, exotic matter is very hard to contain, requiring 4D traps to stop it from simply flinging itself back to the summit, and it unravels violently in reaction to both regular and antimatter. This document is meant to be brief, so look for more details in a specialised article.

5-CONTEMPORARY TECH POWERED BY HYPERSPACE

Hyperspace has proved invaluable to contemporary society. From FTL travel to forcefields to an infinite (relatively) clean energy source, it can do everything. Let’s take a look at how.

i)The Frame-Shrinkage Engine (FSE)

The FSE is, perhaps, the most important technological discovery of the latter millennium, and facilitated the consequence-free lavishness of the post-work era.

It is, in essence, a power generator, driven by antimatter-matter annihilation and hyperspatial geometry. Here is the baby’s-first explanation for FSE mechanics.

Firstly, the FSE is kickstarted. Through an antimatter fuel charge, a burst of high-energy photons is produced. That burst is funnelled into a beam, and that beam is redirected towards the “up” direction in hyperspace, using a specialised 4D lens. The FSE is a 4D construct, so the high-energy beam is contained within the FSE itself.

As the beam travels “up”, it begins to accelerate due to the increased light speed limits of higher hyperspace, drawing energy from the tension of hyperspace itself as it pushes. The accelerated beam is then caught by a compactor field (no time to go into its mechanics here, sadly)and split into matter -antimatter pairs.

In fact, because of the increased energy contained in the beam, the final mass of matter and antimatter will be *more* than the original fuel charge!
Then, the fuel is pumped back “down”, is annihilated again, and the process starts over.

Once the kickstart is complete and the FSE is reaching “critical mass” (there is a limited amount of matter-antimatter mass it can handle) it will start using the excess energy to power other systems.

The FSE, therefore, is like a power plant that contains its own mine. The more energy it produces, the more fuel it “digs up”.

However, that fuel is not infinite. As we have discussed before, hyperspace is naturally slackening, and FSE's accelerate that process, turning hyperspatial tension to electricity.
In fact, this universal effect of FSE's was the key to both confirming alien civilizations were out there, as well as their general location in the multiverse.

So how do we justify still using FSE's, despite the fact that they hasten the process of cataclysmic dichotomisis? It has to do with scale.

Imagine a sandy beach, a good few kilometres wide.
Every time collective civilization uses up the equivalent of the energy of a star's entire lifetime, take away one grain. When every single grain of sand on the beach is gone, the most delicate instrument ever created for measuring hyperspatial tension will tick over by a single bit.

It's not an endless pit of energy, but it may as well be. Heat death will come a lot faster than the flattening of hyperspace, even *with* our acceleration of the process.

ii)Field Manipulators/Fieldweavers
FMs are, to a layman, "telekinesis machines". This is not a bad way to look at them, as they are often referred to as SAD (Spooky Action at a Distance) Machines by the engineering communities who build and maintain them.

FMs work by "entangling" the fundamental fields of a volume of realspace with those of another volume, the second of which is enclosed within the FM. By pumping energy into the "internal" volume, the external volume is changed, as if mirrored.
They can be delicate enough to individually alter the atoms in a molecule, and powerful enough to crack a star open like an egg.

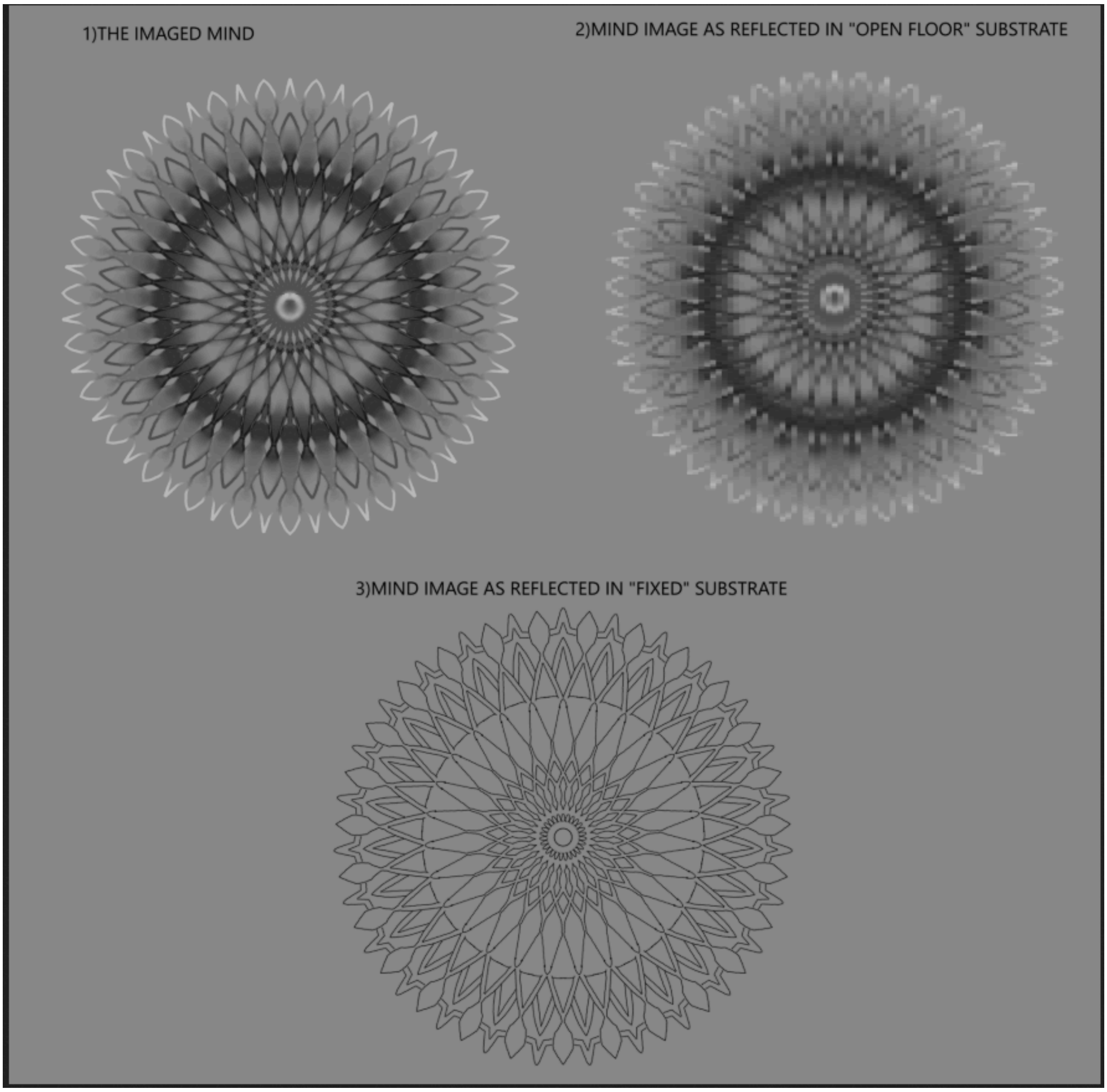
Field Manipulators will get their own paper detailing their mechanics, so keep an eye out for that.

iii)Intelligence Complex Substrates (ICs)

IC substrates are 4D, light-based computational structures that harness the higher light speed in hyperspace to process data at unfathomable speeds.
IC substrates come in a wide variety of types, to suit the many tasks they perform.

They are used to run universe simulations, to regulate autonomous systems, as “soulkeepers”, and most importantly, to host the minds of Vessels.

They come in two broad structural categories - open floor, and fixed.



5.1-*Impressionistic “mind image” diagrams*

Image 5.1 might be a bit “artistically interpretive”, but it is good at getting the “vibe” of these substrates across.

“Open floor” substrates trade imaged resolution & speed for reliability, flexibility, and safety.
This type of substrate is “decentralised”, meaning that even if it was cut in half, both halves would still retain function as two smaller ICs, despite losing access to half of their original substrate.
This is because every part of an “open floor” substrate can turn into any other part. Every “hypervoxel” of the substrate can act as part of a memory storage unit, as an independent piece of an internal FSE, or as a computational neuron, with very quick transformation times.

“Fixed” substrates trade all of the above for pure calculational speed, and are thus used very situationally - mainly, in very demanding simulative systems and as a “war-mode” alternative substrate for vessels.