1 The Pi-Space Formulas

In this chapter, I'll show how one can alter some existing Physics formulas so that they work for v < C and v << C. Newton's formulas assume that velocity and acceleration are linear but we can use our knowledge of Pi-Space to produce more general forms. This is without the need for General Relativity. I'll cover General Relativity after this and address those formulas too from the perspective of Pi-Space.

These advanced formulas cover

Einstein Special Relativity, Energy
Newton Gravity, Acceleration, Velocity
Orbits
Bernoulli
Navier-Stokes
Hooke
Simple Harmonic Motion

1.1 More general form of E=MC^2

I'll start with the simplest change which is a modification to the Einstein Mass Energy Equation. We add the constant Pi.

$$E = m\left(\pi c^2\right)$$

This is due to the Square Rule. All we need to do here is add the constant π.

1.2 Velocity addition and Subtraction in Pi-Space

In Pi-Space, there are two classifications of addition and subtraction. The first classification is straight-forward addition and subtraction in a non-Inertial framework; namely where there is no acceleration or deceleration to go from v1, to v2. For this case, use the Einstein velocity addition and subtraction formulas.

In the second case, we have an Inertial Framework in which going from v1 to v2 requires a constant rate of change of velocity (AKA acceleration). For this case, you'll need to use Pi-Space formulas which model how a Pi-Shell loses or gains area over time.

1.3 General Solution (v<<C and v<C) To Kinetic Energy Using Pi-Space

The Pi-Space formula for the general solution to Kinetic Energy in Pi-Space is

$$KEvelocity = m * \left(1 - Cos\left(ArcSin\left(\frac{v}{c}\right)\right)\right)$$

This formula is relativistic and gives the same answers as the Newtonian formula where v<<C and also provides the correct answer where v<C. What's more, you don't need General Relativity.

The Proof (ignoring mass)

Sum up the velocities from 0..V where there is a constant acceleration. Sin x represents the constant area gain represented in terms of the Pi-Shell diameter. To sum up the velocities we use integration. The input angle is part of a right-angled triangle which represents three Pi-Shells (constituting Pi-Shell addition) as I've shown already.

$$\int_{o}^{v/c} \sin x(dx)$$

Which produces, where x = v/c

$$1 - Cos\left(\frac{v}{c}\right)$$

However, v/c is a diameter value and we need to convert it into an angle (because that's what Cos needs) so we use an inverse sin function. To elaborate further, ArcSin() takes a value 0..1 and maps it to 0..Pi/2. In our case, 1 is V/C so it maps from Pi-Space velocity to the Trignometric version of our Pi-Space formulas where I show for example a right angled triangle.

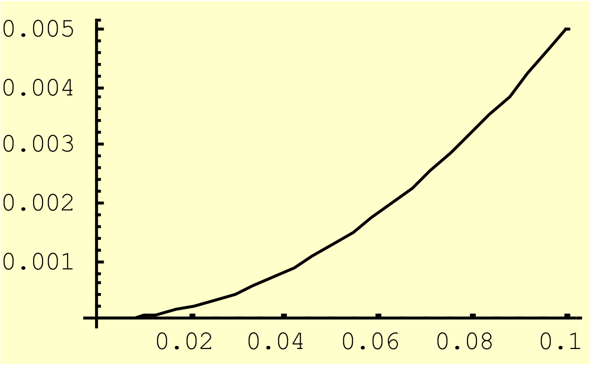
$$1 - Cos\left(ArcSin\left(\frac{v}{c}\right)\right)$$

We don't need to do anything further as we've summed up the total velocities. The way Newton did this was he squared the velocities and halved the result. We don't need to halve the result as the reason he halved the result was to get the sum of the average velocities. At v<C the velocity is almost the same so we can have an average and this is why his formula works.

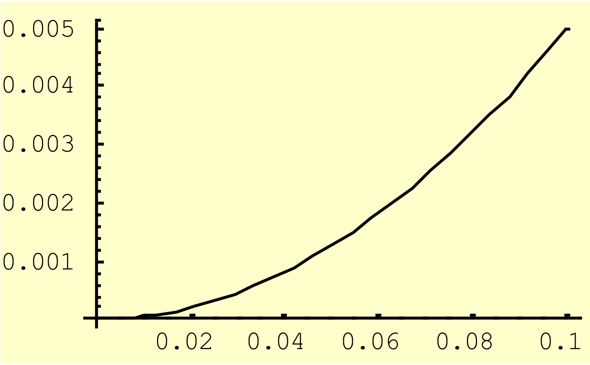
So if we take v=0.1C, the Newtonian result is 0.05 and if we apply it to this formula we get the same result. However, at v=0.9, the values differ.

Exercise: In Mathematica, try plotting v at 0 to 0.1 for the Newtonian and Pi-Space formula. Both return 0.05.

```
Plot[1 -Cos[ArcSin[v]],{v,0,0.1}];
```



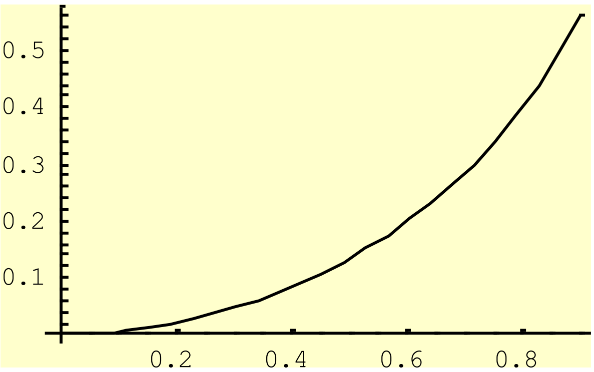
Plot[(v*v)*0.5,{v,0,0.1}];



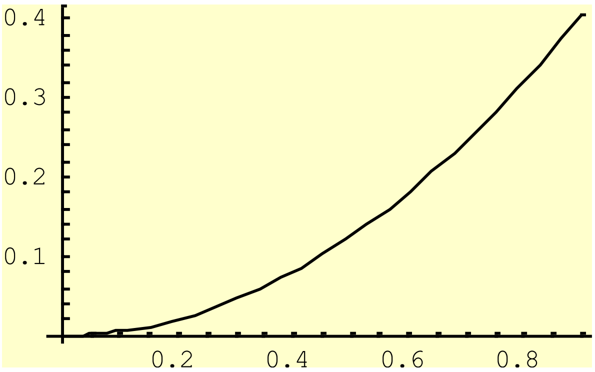
Note that the two charts are almost identical where v<<C.

Now change v=0 to 0.9

Plot[1 -Cos[ArcSin[v]],{v,0,0.9}];



Plot[(v*v)*0.5,{v,0,0.9}];



The values match at the lower relativistic values. Again, we can use Mathematica to plot the values.

Table[1-Cos[ArcSin[v]],{v,0,1.0, 0.1}]
{0,0.00501256,0.0202041,0.0460608,0.0834849,0.133975,0.2,0.285857,0.4,0.56411,1.}

Table[(v*v)*0.5,{v,0,1.0,0.1}]
{0,0.005,0.02,0.045,0.08,0.125,0.18,0.245,0.32,0.405,0.5}

Placing this is a comparison tables

Velocity 0..V, constant acc	Newtonian KE	**Pi-Space KE**
0.1	**0.005**	0.00501256
0.2	**0.02**	0.0202041
0.3	**0.045**	0.0460608
0.4	**0.08**	0.0834849
0.5	**0.125**	0.133975
0.6	**0.18**	0.2
0.7	**0.245**	0.285847
0.8	**0.32**	0.4
0.9	**0.405**	0.56411
1.0	0.5	1

So, using the Newtonian KE formula at V=C=1.0 which is the fastest possible speed, one has KE of 0.5. However, at the lower speeds, it matches the Pi-Space KE formula because the slope of both curves is almost linear. At V=1.0 for the Pi-Space KE formula, KE is 1.0. Note: The total area of the Pi-Space is Pi/2 * 1 which is Pi/2. Non-linear combined velocity accounts for 1. In the Newtonian view, it's 1 * 1. Linear combined velocity accounts for 0.5.

So Newtonian KE maps to 0.5CC (area) for Combined Velocities 0..C
And
Pi-Space KE maps to 1CC (area) for Combined Velocities 0..C.

Therefore we can see that Einstein's Energy Formula E=MCC tallies with the Pi-Space KE formula MCC for V=0..C (where we add Mass M). Earlier I showed how Einstein's Energy Formula mapped to Pi-Space area using the Square Rule. (Shortly, I'll explain why Einstein's Relative Kinetic Energy formula produces Infinity and how that tallies with this equation which does not.)

So, this is where we see a big win in Pi-Space beyond just reverse engineering other formulas. We can create our own. By understanding the geometry of Pi-Space, we can use Trig and some Integration to figure out your average speed at you'd fall into a black hole! We use Integration to add up the individual velocities which are related to the rate of area change.

Note: The total area of Sin(x) where x is 0 to Pi/2 is Pi/2 * 1 which equals Pi/2. The area under the curve in this case is 1.0. It is not the total area which is Pi/2.

Please note that this is the energy of the object in question not the work done on the object which is a slightly different thing.

Let's understand this equation in terms of the Einstein Relative Kinetic Energy formula.

Einstein formulated Relative Kinetic Energy as

$$\frac{mc^2}{\sqrt{1-\frac{v^2}{c^2}}} - mc^2$$

This formula produces infinity where v=c. The infinite energy refers to the work done to accelerate an object to c. It's the work done by another object or force which is doing the work. For example, it's the work done by the person pushing the rock, not the energy of the rock itself. In Pi-Space, the Relative Kinetic Energy formula described models the energy of the moving object itself (the rock, using the analogy) and not that of the object applying the force (the person). Einstein's formula models the person doing the pushing of the rock. Let's derive our formula to look like the Einstein one and see how they compare.

$$1 - Cos\left(ArcSin\left(\frac{v}{c}\right)\right)$$

Simplify Cos(ArcSin(v/c)) to use Square Root equivalent

$$1 - \sqrt{1-\frac{v^2}{c^2}}$$

Where 1 = mc^2 (no longer using standard units)

$$mc^2 - mc^2\sqrt{1-\frac{v^2}{c^2}}$$

One of the major arguments in favor of the Einstein equation being correct is that it represents the Newtonian equivalent where v << C because of the Binomial expansion. In Mathematica, we can express this as.

Series`[1/Sqrt[1-x^2],{ x,0,10}]`

$$1+\frac{x^2}{2}+\frac{3x^4}{8}+\frac{5x^6}{16}+\frac{35x^8}{128}+\frac{63x^{10}}{256}+O[x]^{11}$$

The second term x^2/2 represents 1/2mv^2 in the Newtonian equation where v << c.

Let's apply the same analysis to the Pi-Space equation.

Series `[Sqrt[1-x^2],{ x,0,10}]`

$$1-\frac{x^2}{2}-\frac{x^4}{8}-\frac{x^6}{16}-\frac{5x^8}{128}-\frac{7x^{10}}{256}+O[x]^{11}$$

$$mc^2-mc^2+\frac{x^2}{2}+\frac{x^4}{8}...$$

This also approximates the Newtonian Equation where v << c as the second term is x^2/2.

So, summing up. The Pi-Space Relative Kinetic Energy equation represents the Kinetic Energy of the object in question. Einstein's Relative Kinetic Energy formula models the object doing the work which becomes infinite when v = C. The Pi-Space Kinetic Energy formula does not go to infinity but to c^2 at v = c, which was always the total energy of the object in the first place. However, the Einstein equation correctly shows that it takes an infinite amount of work to achieve this kinetic energy state.

Why is this distinction important? The reason why this is important is that when we describe Kinetic Energy using the roller coaster analogy within Gravity, we describe the energy of the roller coaster itself which is what the Pi-Space formula describes; the energy of the object itself.

Example.

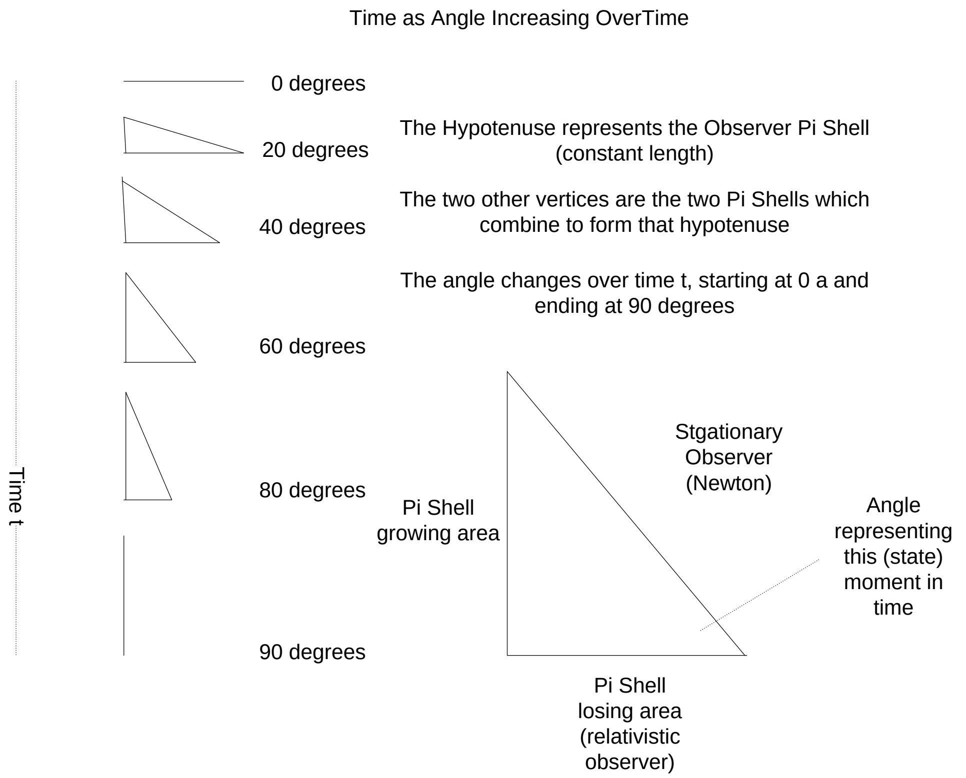
Let's convert 20 Miles Per Second into Kinetic Energy and get the Newtonian result and then use the Pi-Space formula. Here I use Mathematica expressions.

Mass = 1,
Newton KE = 0.5*((20)^2) = 200

Miles Per Second 186000
Pi-Space KE = (1 - Cos[ArcSin[20.0/186000.0]])*(186000^2) = 200
Note how we multiply by C^2 to get back to the Newtonian analogue

1.4 Representing Flow of Time as an Angle Change in Pi-Space

I've already shown that time is proportional to the diameter of a Pi-Shell. Using the SR formulas, we can see that a smaller Pi-Shell has slower time than a larger one. However, an important question arises when an object falls under Gravity or accelerates. How can one represent the rate of change of time with respect to area change? The Pi-Shell diagrams I've shown so far do not have any concept of time, except for showing a larger one has a differing clock tick. How can one accurately measure time or visualize it in Pi-Space? The answer goes back to the right-angled triangle. I've shown how we can measure KE more accurately using a Pi-Shell which is gaining area. I turned the proportion of c, namely v/c into an ArcSin equivalent which is the angle representing the proportion of area change. This is the angle in a right-angled triangle. Also, I've already shown that a right-angled triangle represents Pi-Shell addition where one Pi-Shell represents the change in area and the other is the remaining Observer Pi-Shell area leading to the need for relativity calculations. Therefore, as the angle changes in a right-angled triangle the amount of area changes also which is our focus for this discussion. For the sake of convention, we can assume that the perpendicular line segment represents the Pi-Shell whose area is growing. This can be assumed to be the area loss due to acceleration.



What is significant about this angle area change? The answer is that it represents a constant rate of area change wrt to the diameter of a Pi-Shell. What we are looking at is how a Pi-Shell loses area as it falls under Gravity or generally accelerates. So, if we take a unit of constant area change over time and we can represent it as a Pi-Shell starting at 0 and ending up at a particular v/c, we can break the rate of change up into 0 to 90 degrees and this acts as the timer, namely the per second timer, as v/c is per second.

Importantly, the angle change is proportional to the line segments which are diameter representations of a Pi-Shell. Therefore, the angle is proportional to the rate of change of time which is proportional to the diameter.

1.5 General Solution (v<<C and v<C) To Potential Energy Using Pi-Space

The general solution to Potential Energy is to place it equal to the new Kinetic Energy equation.

$$\frac{gh}{c^2} = 1 - Cos\left(ArcSin\left(\frac{v}{c}\right)\right)$$

Therefore we can see that Gravity is non-linear as v<C and linear as v <<C. However, it would be nice to derive a more general acceleration formula based purely on velocity change as Newton did. This is covered as the general solution to acceleration.

1.6 Solving for KE=PE for v/c where v<C and v<<C

Let's derive the v/c solution to KE=PE. The usefulness of this approach is that this can later be used to derive the escape velocity for an object attempting to escape a Gravity field or if one would like to understand ones velocity after falling a certain distance under Gravity.

$$\frac{gh}{c^2} = 1 - Cos\left(ArcSin\left(\frac{v}{c}\right)\right)$$

$$1 - \frac{gh}{c^2} = Cos\left(ArcSin\left(\frac{v}{c}\right)\right)$$

$$ArcCos\left(1 - \frac{gh}{c^2}\right) = ArcSin\left(\frac{v}{c}\right)$$

$$\frac{v}{c} = Sin\left(ArcCos\left(1 - \frac{gh}{c^2}\right)\right)$$

The values match at the lower relativistic values. Again, we can use Mathematica to plot the values. Note gh/cc must be less <= 1 as it is a relativistic formula.

```
Table[Sin[ArcCos[1-gh]],{gh,0,1.0, 0.1}]
{0,0.43589,0.6,0.714143,0.8,0.866025,0.916515,0.953939,0.979796,0.994987,1.}
```

```
Table[Sqrt[2*gh],{gh,0,1.0,0.1}]
{0,0.447214,0.632456,0.774597,0.894427,1.,1.09545,1.18322,1.26491,1.34164,1.41421}
```

Placing this is a comparison tables

gh/cc	Newtonian Velocity	**Pi-Space Velocity**
0.0	**0.0**	0.0
0.1	**0.447214**	0.43589
0.2	**0.632456**	0.6
0.3	**0.774597**	0.714143
0.4	**0.894427**	0.8
0.5	**1.0**	0.866025

0.6	**1.09545**	0.916515
0.7	**1.18322**	0.953939
0.8	**1.26491**	0.979796
0.9	**1.34164**	0.994987
1.0	1.41421	1.0

As we can see, the Newtonian Velocity is > C while the Pi-Space solution is 1.0 when PE=1.0C.

Important note:

$$Sin\left(ArcCos\left(1-\frac{gh}{c^2}\right)\right)=Cos\left(ArcSin\left(1-\frac{gh}{c^2}\right)\right)$$

So we can represent it this way if we choose. We leave it this way for the example to show how it was derived but it's possible to use it the other way if preferred.

1.7 Solving for KE=PE Escape Velocity where v<C and v<<C

We start with the Newtonian formula

$$\tfrac{1}{2}mv^2=-\frac{GM}{r}$$

We can convert to the Pi-Space version

$$-\frac{GM}{r}=1-Cos\left(ArcSin\left(\frac{v}{c}\right)\right)$$

Solving for v/c, Note GM/r is divided by c^2

$$\frac{v}{c}=Sin\left(ArcCos\left(1-\frac{GM}{r}\right)\right)$$

Adjusting to Pi-Space units of area

$$\frac{v}{c}=Sin\left(ArcCos\left(1-\frac{\left(\frac{GM}{r}\right)}{c^2}\right)\right)$$

To get back a Newtonian velocity we need to multiply by C

$$v = Sin\left(ArcCos\left(1 - \frac{\left(\frac{GM}{r}\right)}{c^2}\right)\right) * c$$

Which is the same as

$$v = Cos\left(ArcSin\left(1 - \frac{\left(\frac{GM}{r}\right)}{c^2}\right)\right) * c$$

So what we need is the mass of the planet and the radius.

Body	Mass (kg)	Radius (km)
Earth	$5.98 * 10^{24}$	6378
Mercury	$3.30 * 10^{23}$	2439
Venus	$4.87 * 10^{24}$	6051
Mars	$6.42 * 10^{23}$	3393
Jupiter	$1.90 * 10^{27}$	71492
Saturn	$5.69 * 10^{26}$	60268
Uranus	$8.68 * 10^{25}$	25559
Neptune	$1.02 * 10^{26}$	24764
Pluto	$1.29 * 10^{22}$	1150
Moon	$7.35 * 10^{22}$	1738
Ganymede	$1.48 * 10^{23}$	2631
Titan	$1.35 * 10^{23}$	2575
Sun	$1.99 * 10^{30}$	696000

Let's take the example of the Earth using the traditional Newtonian mechanism.

As an example, the mass **M** of the Earth is $5.98 * 10^{24}$ kilograms. The radius **r** of the Earth is 6378 kilometers, which is equal to $6.378 * 10^6$ meters. The escape velocity at the surface of the Earth can therefore be calculated by:

$$v_{esc} = (2 * G * M / r)^{1/2}$$
$$= (2 * (6.67 * 10^{-11}) * (5.98 * 10^{24}) / (6.378 * 10^{6}))^{1/2}$$
$$= 1.12 * 10^{4} \text{ meters/second}$$
$$= 11.2 \text{ kilometers/second APPROX}$$

Mathematica **Sqrt[2*(6.67*10^-11)*(5.98*10^24)/(6.378*10^6)] =** 11183.7

So, let's use the Pi-Space formula.

First point to note is that the Gravitational potential must be expressed in terms of an area change.

So we need to have the speed of light which is 299,792,458 meters per second.

Also, once we have the result, this is an area calculation; we need to convert it back to a velocity so we need to multiply the answer by the speed of light.

This equates to the following Mathematica expression.

Sin[ArcCos[1-((((6.67*10^-11)*(5.98*10^24))/(6.378*10^6))/(299792458^2))]] * 299792458

This produces an answer of 11183.7 meters per second, or 11.1837 kilometers per second.

TODO: Fill out the other planets

Planet	**Mass**	**Radius**	**Newton Escape Velocity**	**Pi-Space E/V**
Earth	$5.98 * 10^{24}$	6378	11183.7	11.1837
Mercury	$3.30 * 10^{23}$	2439		
Venus	$4.87 * 10^{24}$	6051		
Mars	$6.42 * 10^{23}$	3393		
Jupiter	$1.90 * 10^{27}$	71492		
Saturn	$5.69 * 10^{26}$	60268		
Uranus	$8.68 * 10^{25}$	25559		
Neptune	$1.02 * 10^{26}$	24764		
Pluto	$1.29 * 10^{22}$	1150		
Moon	$7.35 * 10^{22}$	1738		

Ganymede	$1.48 * 10^{23}$	2631		
Titan	$1.35 * 10^{23}$	2575		
Sun	$1.99 * 10^{30}$	696000		

1.8 Solving for a Black Hole Event Horizon

Let's derive the radius solution where a Gravity field completely compresses the mass. This is more commonly called the event horizon or Schwarzchild radius. In this case, we assume the velocity is equivalent to the Speed of Light which means the atom is completely compressed.

$$\frac{\left(\frac{GM}{r}\right)}{c^2} = 1 - Cos\left(ArcSin\left(\frac{c}{c}\right)\right)$$

$$\frac{\left(\frac{GM}{r}\right)}{c^2} = 1$$

$$\frac{GM}{r} = c^2$$

$$\frac{GM}{c^2} = r$$

$$r = \frac{GM}{c^2}$$

The Newtonian derivation is, where the '2' is due to the averaging of the velocities. Pi-Space does not need to do this as discussed earlier and uses an Integral.

$$r = \frac{2GM}{c^2}$$

Therefore for Earth, the back hole radius is

Newtonian / Schwarzchild derivation
2*(6.67*10^-11)*(5.98*10^24)/(299792458^2) = 0.00887597 = 8.8 mm approx

Versus

Pi-Space derivation
(6.67*10^-11)*(5.98*10^24)/(299792458^2)= 0.00443798 = 4.4 mm approx

1.9 General Solution (v<<C and v<C) To Acceleration

Newton defined acceleration as the rate of change of acceleration with respect to time. The implicit assumption is that acceleration is constant.

$$acceleration = \frac{v_2 - v_1}{t}$$

In Pi-Space, acceleration is linear where v<<C but non-linear where v<C. Generally speaking, we can modify the acceleration equation to include a scaling factor.

$$acceleration = \frac{v_2 - v_1}{t}\alpha$$

Where α is between range [0..1]. If α is 1 then v << C and if v = C then α is 0. When α is 0, there is no acceleration and when α is 1, this is the acceleration we are familiar with on Earth inside a weak Gravity field or when we accelerate our cars for example.

We choose Sine because it represents a constant rate of change of velocity, as I've described earlier. The slope of Sine represents the rate of change of acceleration.

So we need a simple version and a more complex version using Integration for larger velocity ranges.

1. For v2/c – v1/c << C use

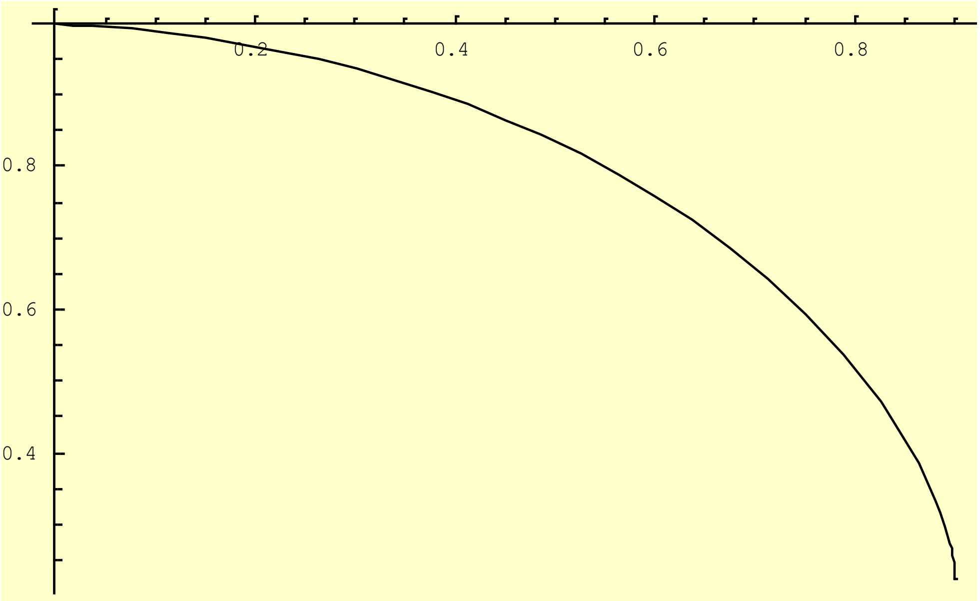
$$v_2' = ArcSin\left(\frac{v_2}{c}\right)$$

$$v_1' = ArcSin\left(\frac{v_1}{c}\right)$$

$$\alpha = \frac{Sin(v_2') - Sin(v_1')}{v_2' - v_1'}$$

In Mathmetica, we can plot constant velocity increases of 0.1 to 0.2, 0.2 to 0.3 etc;

```
Plot[(Sin[ArcSin[x+0.1]]-Sin[ArcSin[x]])/(ArcSin[x+0.1]-ArcSin[x]),{x,0,0.9}];
```



Table[(Sin[ArcSin[v+0.1]]-Sin[ArcSin[v]])/(ArcSin[v+0.1]-ArcSin[v]),{v,0,0.9,0.1}]

{0.998329,0.988235,0.967729,0.936118,0.892204,0.834012,0.758171,0.658338,0.51955,0.221716}

Velocity 0..V, t=1, constant acc	Newtonian Acc m/s/s	**Pi-Space** α
0.0 to 0.1	**0.5**	0.5 * 0. 998329
0.1 to 0.2	**0.5**	0.5 * 0. 988235
0.2 to 0.3	**0.5**	0.5 * 0. 967729
0.3 to 0.4	**0.5**	0.5 * 0. 936118
0.4 to 0.5	**0.5**	0.5 * 0. 892204
0.5 to 0.6	**0.5**	0.5 * 0. 834012
0.6 to 0.7	**0.5**	0.5 * 0. 758171
0.7 to 0.8	**0.5**	0.5 * 0. 658338
0.8 to 0.9	**0.5**	0.5 * 0. 51955
0.9 to 1.0	0.5	0.5 * 0. 221716

Also for V=C (0.999999C to 1.0)

(Sin[ArcSin[1.0]]-Sin[ArcSin[0.999999]])/(ArcSin[1]-ArcSin[0.999999])= 0.000707107

So there is virtually no acceleration near the speed of light as the Pi-Shell has no remaining area.

2. For v2/c – v1/c < C, you can use an Integral, summing and then averaging all the slopes. You can assume Δx = 0.0001

$$\alpha = \frac{\int_{v_1'}^{v_2'} \frac{Sin(x+\Delta x) - Sin(x)}{\Delta x}}{v_2' - v_1'}$$

e.g. (NIntegrate[((Sin[x]-Sin[x-0.000001])/0.000001),{x,0, 1.5707}])/(1.5707)

Table[((NIntegrate[((Sin[x]-Sin[x-0.000001])/0.000001),{x,i,i+0.1}])/(0.1)),{i,0,1.57,0.1}]

{0.998334,0.988359,0.968509,0.938982,0.900072,0.85217,0.795752,0.731384,0.659709,0.581441,0.497364,0.408318,0.315191,0.218916,0.120453,0.0207867}

Proof

Consider an object with velocity v1 accelerating to v2 over time t.

Acceleration is the rate of change of velocity with respect to time

In Pi-Space, acceleration is the rate of change of Pi-Shell area loss with respect to time

In Pi-Space, the change of area of a Pi-Shell is modeled by the Sin(x) function representing the per second area change in terms of its diameter.

The diameter line represents v/c and the angle represents per second time t.

Therefore 0..90 degrees represents a Pi-Shell accelerating from 0..v/c in time t, per second.

From differential calculus, acceleration is the slope of the velocity change.

The slope of the sin(x) function between v2/c and v1/c therefore represents acceleration. We turn v2/c and v1/c into an angle using the ArcSin() function.

To calculate the slope, one needs to add the slope at each point and add them up, then average them over the range of velocities under consideration.

We use an Integral to add up the individual y/x slopes.

Then we divide the summed slopes by the range of angles to get the average acceleration over that range.

In the case where v << C, we can subtract the velocities and divide by the angle difference which is equivalent to time.

1.10 Pi-Space Solution to Einstein's SR Lorenz-Fitzgerald Relativity Formula

There is no question to the fact that Einstein's SR Lorenz-Fitzgerald formula works. However, it's possible to derive this formula independently of the Einstein approach without using rods and clocks. Let's see how we can derive it in Pi-Space.

Let's first understand what the Lorenz-Fitzgerald transformation is. It is a scaling factor which represents the change in diameter of the Observer Pi-Shell. Newton's formulas all assume that the Observer Pi-Shell remains the same size. However, Einstein showed that this was incorrect. Once more we return to a right angled triangle. The hypotenuse represents the stationary Observer or the Newtonian Observer whose size is 1. The other two Pi-Shells represents the Pi-Shell whose area is growing and whose area is shrinking. The Pi-Shell whose area is growing represents the Newtonian Observer loss of area due to velocity. The other Pi-Shell whose area is shrinking represents the non-Newtonian or relativistic Observer whose Pi-Shell is shrinking due to velocity area loss.

In order to correctly adjust the velocity, we must calculate the proportion of the Newtonian Observer to the Relativistic Observer. How can we do this in Pi-Space? We already know the amount of area gain due to velocity we can calculate it using Sine as this is area gain in terms of the right-angled triangle.

$$PiSpaceVelocity = Sin\left(ArcSin\left(\frac{v}{c}\right)\right) = \frac{v}{c}$$

Note: This is the velocity relative to the Newtonian Observer and is equivalent to Newtonian velocity.

$$NewtonianObserver = Hypotenuse = 1$$

Therefore, the relativistic observer is the remaining area of a right-angled triangle. Remember that a right-angled triangle represents Pi-Shell area addition, expressed in terms of the diameter. A Pi-Space rule of thumb is that Cosine represents Pi-Shell compression so we use Cosine for the case where we are losing area.

$$\mathrm{Re}\,lativisticObserver = Cos\left(ArcSin\left(\frac{v}{c}\right)\right) = \sqrt{1-\frac{v^2}{c^2}}$$

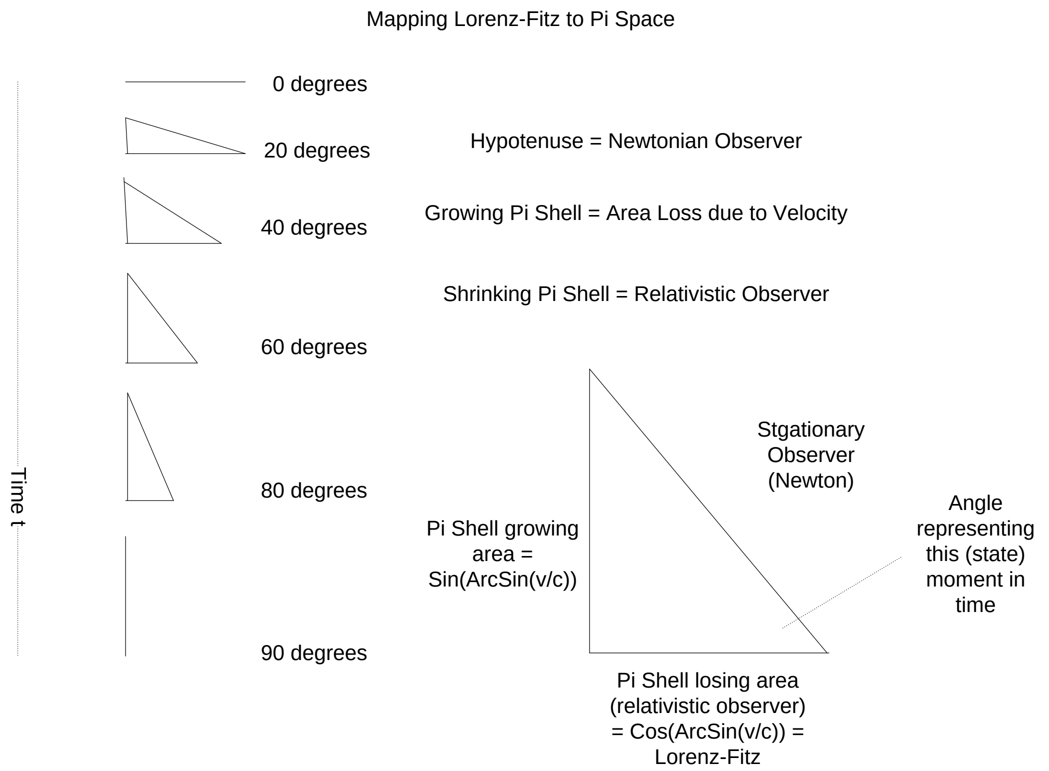
This is equivalent to

$$SRLorenzFitzgerald = \sqrt{1-\frac{v^2}{c^2}}$$

Therefore, if we want a relativistic velocity, we need to calculate the non-relativistic velocity by the Relativistic Observer

$\mathrm{Re}\,lativisticVelocity = \mathrm{Re}\,lativisticObserver *$ <property>

We can use this value for time, length x and mass as these are all properties of a Pi-Shell.



Velocity 0..C	Lorenz-Fitzgerald Sqrt(1-v/c*v/c)	**Pi-Space Cos(ArcSin(v/c))**
0.0	**1.0**	1.0
0.1	**0.994987**	0.994987
0.2	**0.979796**	0.979796
0.3	**0.953939**	0.953939
0.4	**0.916515**	0.916515
0.5	**0.866025**	0.866025
0.6	**0.8**	0.8
0.7	**0.714143**	0.714143
0.8	**0.6**	0.6
0.9	**0.43589**	0.43589
1.0	0.0	0.0

1.11 General Solution to the Average Velocity (v<<C, v<C)

One of the key aspects of Newton's formulas is the calculation of the average velocity. Newton's approach is to assume Gravity is linear therefore the velocity gain is linear. The average velocity is half-way along the velocity change.

$$\bar{v} = \frac{v_0 + v}{2}$$

In Pi-Space, we can sum the velocities to produce Kinetic Energy. The average velocity is therefore the sum of the velocities, divided by the velocity range.

$$\frac{\int_o^{ArcSin\left(\frac{v}{c}\right)} \sin x(dx)}{ArcSin\left(\frac{v}{c}\right)}$$

Which produces, where x = v/c

$$\frac{1 - Cos\left(ArcSin\left(\frac{v}{c}\right)\right)}{ArcSin\left(\frac{v}{c}\right)}$$

Table[(1-Cos[ArcSin[x]])/(ArcSin[x]), {x,0.1,1, 0.1}]

Velocity 0..C	Newton Average velocity	**Pi-Space Average Velocity**
0.0	**0.0**	0.0
0.1	**0.05**	0.0500418
0.2	**0.1**	0.100339
0.3	**0.15**	0.151171
0.4	**0.2**	0.202871
0.5	**0.25**	0.255873
0.6	**0.3**	0.3108
0.7	**0.35**	0.368659
0.8	**0.4**	0.431362
0.9	**0.45**	0.503773
1.0	0.5	0.63662

1.12 General Solution to Distance an Object Travels as it Accelerates

The distance an object travels while accelerating is defined by Newton as

$$distance = v_0 t + \frac{1}{2} a t^2$$

We're interested in the second part of the formula, which is the acceleration part

$$accelerationDistance = \frac{1}{2} a t^2$$

This is the summing up of the Kinetic Energy component over time t and averaging it which produces the general version of the formula. Time t is multiplied by acceleration a, to produce a velocity v and halved to get the average velocity. The average velocity is then multiplied by time t once more to get the distance traveled.

$$distance = v_0 t + \left(\frac{1 - Cos\left(ArcSin\left(\frac{at}{c} \alpha \langle v_0, v_0 + at \rangle \right) \right)}{ArcSin\left(\frac{at}{c} \alpha \langle v_0, v_0 + at \rangle \right)} \right) t$$

Where

$$\frac{at}{c} \alpha \langle v_0, v_0 + at \rangle \le 1$$

Note: α is applied to the acceleration range vel *start* to vel *end* e.g. 0.1 to 0.2C

Note: There is no straight-forward way to solve for time t using this approach but it is more accurate while calculating distance.

Table[((1-Cos[ArcSin[0.01*t]])/(ArcSin[0.01*t]))*t,{t,1,10,1}]
{0.00500004,0.0200007,0.0450034,0.0800107,0.125026,0.180054,0.2451,0.320171,0.405274,0.500418}

Versus

Table[(0.5.01*(t*t)), {t,1,10, 1}]*

Time in seconds, acc=0.1m/s/s	Pi-Space Distance	**Newton Distance**
1	**0.00500004**	0.005
2	**.0200007**	0.02
3	**0.0450034**	0.045
4	**0.0800007**	0.08
5	**0.0800107**	0.125
6	**0.180054**	0.18
7	**0.2451**	0.245
8	**0.320171**	0.32
9	**0.405274**	0.405
1.0	0.500418	0.5

1.13 General Solution to the final velocity of a falling Object

When something is dropped under Gravity, one quickly asks the question when it hits the ground, how fast was it traveling if it traveled distance x? Newton answered this question with the following formula.

$$V_f^2 = V_o^2 + 2ax$$

This formula can be derived in Pi-Space in the same way that Newton derived it by matching Kinetic Energy to Potential Energy.

$$gh = \frac{1}{2} v^2$$

Velocity v is the final velocity and Newton solved by breaking out its constituent parts.

$$2gh = v_0^2 + v_f^2$$

This produces the final formula where gh and are replaced by acceleration a and distance x. Let's solve this in Pi-Space.

$$\frac{gh}{c^2} = 1 - Cos(ArcSin(V_f - V_0))$$

$$Cos(ArcSin(V_f - V_0)) = 1 - \frac{gh}{c^2}$$

$$V_f - V_0 = Sin\left(ArcCos\left(1 - \frac{gh}{c^2} \right) \right)$$

$$V_f = V_0 + Sin\left(ArcCos\left(1 - \frac{gh}{c^2} \right) \right)$$

$$V_f = V_0 + Sin\left(ArcCos\left(1 - \frac{ax}{c^2} \alpha\langle v_0, v_0 + ax \rangle \right) \right)$$

Table[(Sqrt[2*x]),{x,0.1,1,0.1}]

{0.447214,0.632456,0.774597,0.894427,1.,1.09545,1.18322,1.26491,1.34164,1.41421}

Table[(Sin[ArcCos[1-x]]),{x,0.1,1,0.1}]

{0.43589,0.6,0.714143,0.8,0.866025,0.916515,0.953939,0.979796,0.994987,1.}

And for smaller values

Table[(Sin[ArcCos[1-x]]),{x,0.000001,.00001,0.000001}]

{0.00141421,0.002,0.00244949,0.00282842,0.00316227,0.0034641,0.00374165,0.00399999,0.00424263,0.00447212}

Table[(Sqrt[2*x]),{x,0.000001,.00001,0.000001}]

{0.00141421,0.002,0.00244949,0.00282843,0.00316228,0.0034641,0.00374166,0.004,0.00424264,0.00447214}

1.14 Distance Travelled at Final Velocity

$$2gh = v_0^2 + v_f^2$$

$$h = \frac{v_0^2 + v_f^2}{2g}$$

Vo is 0

$$h = \frac{v_f^2}{2g}$$

Solving in Pi-Space, KE = PE

$$\frac{gh}{c^2} = 1 - Cos\left(ArcSin\left(V_f - V_0\right)\right)$$

$$V_o = 0$$

$$\frac{gh}{c^2} = 1 - Cos\left(ArcSin\left(V_f\right)\right)$$

$$h = \frac{1 - Cos\left(ArcSin\left(V_f\right)\right)}{g}$$

1.15 Solving for time t to travel distance x

$$dis\tan ce = v_0 t + \left(\frac{1 - Cos\left(ArcSin\left(\frac{at}{c} \alpha \langle v_0, v_0 + at \rangle \right)\right)}{ArcSin\left(\frac{at}{c} \alpha \langle v_0, v_0 + at \rangle \right)} \right) t$$

This does not readily solve for t, however we can use the move out time t and make the equation more like the Newtonian equation. We average the per second diameter line change (acceleration) instead of the final velocity.

$$distance = v_0 t + \left(\frac{1 - Cos\left(ArcSin\left(\frac{a}{c} \alpha \langle v_0, v_0 + at \rangle \right) \right)}{ArcSin\left(\frac{a}{c} \alpha \langle v_0, v_0 + at \rangle \right)} \right) t^2$$

This solves for t in a reasonable manner, similar to the Newtonian equation.

Solve[v*t + ((1-Cos[ArcSin[a]])/(ArcSin[a]))*(t*t) == s,t]

$$\left\{\left\{t \to \frac{-v\,ArcSin[a] - \sqrt{4\,s\,ArcSin[a] - 4\sqrt{1-a^2}\,s\,ArcSin[a] + v^2\,ArcSin[a]^2}}{2\left(1-\sqrt{1-a^2}\right)}\right\},\right.$$
$$\left.\left\{t \to \frac{-v\,ArcSin[a] + \sqrt{4\,s\,ArcSin[a] - 4\sqrt{1-a^2}\,s\,ArcSin[a] + v^2\,ArcSin[a]^2}}{2\left(1-\sqrt{1-a^2}\right)}\right\}\right\}$$

v=0
a=0.01
s=0.405274

Solve[v*t+((1-Cos[ArcSin[(a)]])/(ArcSin[(a)]))*(t*t) == s,t]

{{t→-9.00301},{t→9.00301}} so the solution is 9 seconds

1.16 Newton's Gravity Formula

The typical formula for Gravity is for a planetary body of Mass M.

$$Fg = \frac{GMm}{r^2}$$

The modified Pi-Space formula is essentially the same but it contains the constant Pi. This is because the radius squared is the Square Rule for determining the area of the Pi-Shell in question.

Therefore the Gravity Field is a mass induced field divided by the Pi-Shell for the planet to get a discrete area change. Fg calculates the per atom / Pi-Shell area change as we move within the field. As we move upwards, we gain area relative to the observer and as we move downward we lose area relative to the observer. The Gravitational constant is a scaling factor for the total area change and maps it to a per atom area change wrt to distance h, typically in meters. Time is squared because it's proportional to the diameter change and needs to be squared to map it to an area change which is the overall units. Therefore Gravity which is acceleration has units "meters per second squared".

$$Fg = \frac{G' Mm}{\pi . r^2}$$

$$G^{'} = G * \pi$$

G' is a modified Universal Gravitational constant. The overall result of the formula is the same but hopefully the reason for it working is more intuitive using this formulation.

This modified value is `2.0963847777404688E-10 and is the Pi-Space Universal Gravitation Constant.`

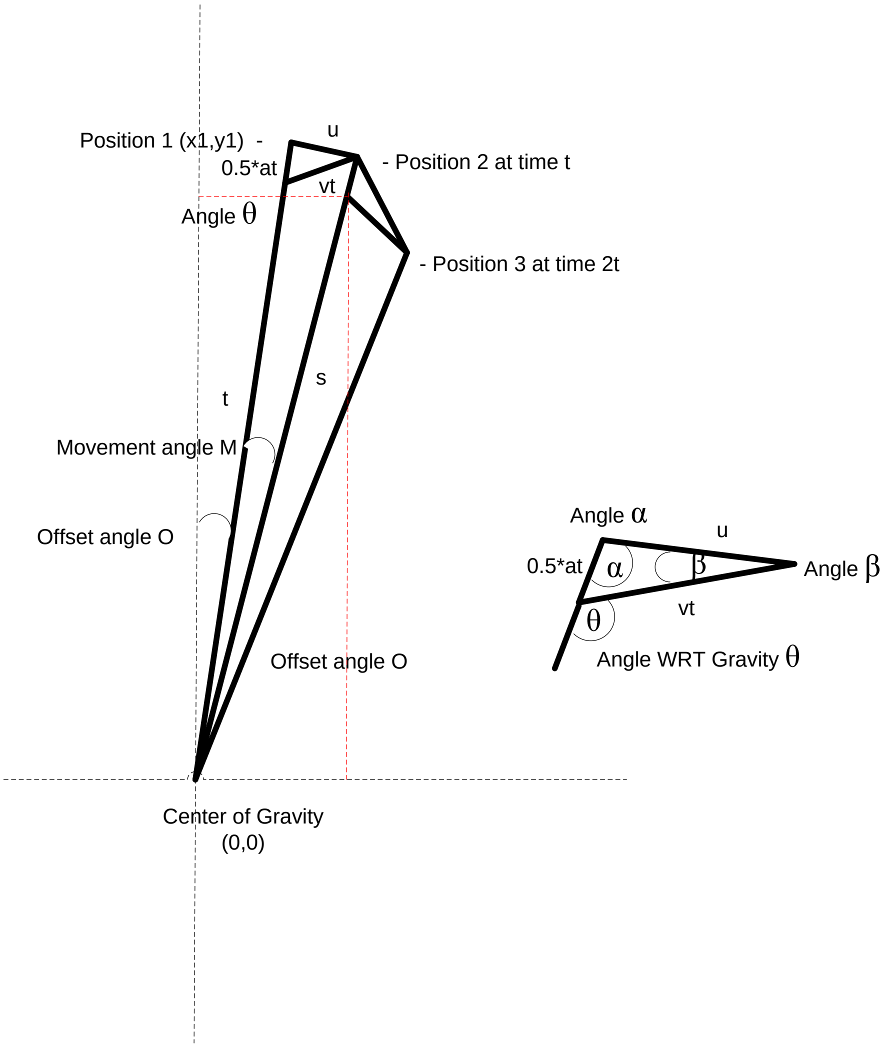
1.17 General Solution to Orbits for Pi Space using Law of the Sines and Law of the Cosines

Typically orbits are covered using Kepler's approach. In Pi-Space, the idea is to come up with a general approach to movement, similar to Newton's Centripetal force idea. In Pi-Space we don't talk about Ellipses or centripetal forces. We talk about adding the force generated by the field with the energy of the moving object. The Law of the Sines and the Law of the Cosines are used to calculate the next position. This is really just a more general form of the Pythagorean Theorem. The idea is that this approach can be used for both trajectories like cannon balls on Earth and the orbits of planets.

We can use the Law of the Cosines and the Law of the Sines to produce an elliptical orbit and the other types of orbits, using these two Laws in Pi-Space. Remember that the position, velocity and time are the Product of Pi-Shell addition. The Law of the Cosines and Law of the Sines are General Pi-Shell addition formulas.

To calculate the orbit, all one needs to know is the distance from the center of gravity, the velocity of the object and its angle with respect to the center of gravity. This is angle θ.

Calculating an Orbit in Pi-Space



The high level steps are.

1. Choose x1,y1 moving with velocity v under an acceleration a and angle θ to that Gravity field, center of gravity distance t, offset angle O wrt to axes
2. Calculate a from Newton a = GM/t^2 (M is mass of object)
3. Calculate the Interior Angle (180 – θ) of orbit triangle
4. From 0.5a*t^2, vt and Interior Angle, calculate u (Law of Cosines)
5. From u,Interior Angle, 0.5a*t^2, calculate β (Law of Sines)
6. Calculate α from 180 – β - InteriorAngle
7. Calculate S from t,u, α (Law of Cosines)
8. Calculate M from s, α,u (Law of Sines)
9. Calculate New Offset Angle = 0 + M
10. Goto step 1, d(new) = s, θ(new) = θ – β, v(new) = u, offset angle O is O+M
11. (new)x1 = s * Cos(90-New Offset Angle), (new)y1 = s * Sin(90-New Offset Angle)

Note: See Appendix A for worked Java code implementing this idea

1.18 Bernoulli And Pi-Space

We have Pitot and Venturi Formulas in Pi-Space

Pitot

$$v = Cos\left(ArcSin\left(1 - \frac{\left(\frac{Pt - Ps}{\rho}\right)}{c^2}\right)\right) * c$$

Venturi

$$Q = A_2 * Cos\left(ArcSin\left(1 - \frac{\left(\frac{P_1 - P_2}{\rho\left(1 - \left(\frac{A_2}{A_1}\right)^2\right)}\right)}{c^2}\right)\right) * c$$

We can calculate the values in the following way

Let's do a simple calculation to solve for velocity knowing pressure. In Pi-Space, Energy is an area loss of a Pi-Shell. Velocity is a diameter line change.

Pressure is an energy calculation and is therefore an area loss.

We use an imperial system example

Where we have PSI

Let's take an example where the dynamic pressure is 1.040 lb/ft^2

Also the density of air is 0.002297 slug/ft^3

Using the classic formula, Using Mathematica

Sqrt[2∗(1.04)/(0.002297)] = 30.092 ft/s

Now let's use the Pi-Space formula

This formula requires that we use the speed of light in feet per second

the speed of light = 983,571,056 foot per second

Sin[ArcCos[1 - (((1.04)/(0.002297))/(983571056^2))]]*983571056 = 29.3127

Now we can see this is not the same as the Classical Result.

The Pi-Space Theory maintains that this is a "more accurate" result than the classical approach.

The Classical Approach is just an approximation.

Let's make Pi-Space match the Classical approach.

For the speed of light, we set it to 9835710 foot per second (incorrect) instead of 983571056 foot per second

Sin[ArcCos[1 - (((1.04)/(0.002297))/(9835710^2))]]*9835710 = 30.092

Therefore, the more accurate the speed of light calculation, the more accurate the Pitot Velocity result in the Pi-Space Theory.

Note: This would have to be proven/disproven by actual experimentation. I do not have the equipment for this.

Here is a table showing the range of values which are approximate to one another.

```
Table[Sin[
  ArcCos[1 - (((psi)/(0.002297))/(983571056^2))]]*983571056, {psi, 1,
  30, 1}]

{29.3127, 41.4544, 50.7711, 58.6254, 65.5452, 71.8012, 77.5541, \
82.9088, 87.9381, 93.8464, 98.3178, 102.594, 106.7, 110.653, 114.47, \
118.163, 121.745, 125.224, 128.609, 131.907, 135.125, 138.268, \
141.341, 144.348, 147.295, 150.183, 153.017, 155.799, 159.209, \
161.885}
```

```
Table[Sqrt[2*(psi)/(0.002297)], {psi, 1, 30, 1}]

{29.5076, 41.7301, 51.1087, 59.0153, 65.9811, 72.2787, 78.0699, \
83.4602, 88.5229, 93.3114, 97.8658, 102.217, 106.391, 110.407, \
114.283, 118.031, 121.663, 125.19, 128.621, 131.962, 135.221, \
```

138.403, 141.514, 144.557, 147.538, 150.46, 153.326, 156.14, 158.904, \
161.62}

1.1 Simple Harmonic Motion solving for v using x and A

Energy Conservation for Harmonic Oscillator

$$\frac{1}{2}kA^2 = \frac{1}{2}kx^2 + \frac{1}{2}mv^2$$

Solving for v classically

$$v = \sqrt{\frac{k}{m}\left(A^2 - x^2\right)}$$

At x=A, velocity is 0

At x=0, velocity is maximum

We can solve the equations in the traditional fashion.

Harmonic Velocity, Amplitude A, position x, Spring force k, mass m.

$$v = \sqrt{\frac{k}{m}}\left(Cos\left(ArcSin\left(1 - \left(\frac{1}{2}\frac{A^2}{c^2} - \frac{1}{2}\frac{x^2}{c^2}\right)\right)\right) * c\right)$$

Worked example

A=5 meters , x=2.5 meters, k=1 N/m ,m=2 N/m

Classic

Sqrt[(1.0/2.0)*((5.0*5.0) - (2.0*2.0))]
Result is 3.24037 m/s

Pi-Space

```
Sqrt[(1.0/2.0)]*
    (
        Cos[ArcSin[1 -
     (
      (
       ((5.0*5.0*0.5) - (2.0*2.0*0.5))/(299792458*299792458)
      )
     )
    ]]
  *299792458
```

)

This produces a result of 3.15883 m/s. This is not the same as the classical result.

Pi-Space maintains that is a more “accurate” result.

To make the result match the Classical Result, we just need to make Speed of Light less accurate (incorrect!) e.g. 2997924

Let’s redo the calculation

```
Sqrt[(1.0/2.0)]*
    (
        Cos[ArcSin[1 -
     (
      (
        ((5.0*5.0*0.5) - (2.0*2.0*0.5))/(2997924*2997924)
       )
      )
    ]]
  *2997924
 )
```

This produces a result of 3.24038 m/s so they match.

This would need to be verified by experimentation. I do not have the equipment for this.

1.2 Average Transverse Kinetic Energy Due To Temperature, solving for velocity

Solving for Velocity in Pi-Space, we have the form

$$v = Cos\left(ArcSin\left(1 - \frac{\frac{3}{2}\frac{kT}{m}}{c^2} \right) \right) * c$$

Let’s solve a problem

Find Transverse KE and Average Velocity

T = 27 Degrees Celsius = 300 Kelvin
Mass Helium = 6.65*10^-27 Kg

Solve for Classic

KEtr = (3/2)∗(1.38∗10^−23)∗(300)= 6.21×10^{-21}

Solving for Velocity

Sqrt[(2.0*(6.2*10^-21))/(6.65*10^-27)]

V = 1365.53 = 1.37*10^3 m/J

Solve for Pi-Space

V =
(Cos[ArcSin[
 1 - (((6.21*10^-21)/(6.65*10^-27))/(299792458^2))]])*(299792458)
Gives us

V = 1366.63 = 1.37*10^3 m/J

1.3 Table of Formulas

Here we compare the Pi Space Theory Formulas versus the established formulas. These are Archimedean formulas in that they are calculated from the properties of Spheres.

Pi-Space units are v/c (atom diameter line change) and g/c^2 (atom area change) relative to Observer

Note: If you want to use these formulas with MPH or Meters, first convert the velocity value to v/c where c = 186000 mps for miles and c = 299,792,458 meters per second. Divide by 60*60 = 3600 if you want a per second value for your velocity. If you have an acceleration or a gravity value which are the same, divide by c^2 where c depends on the units you are working with. When you get a result from the formula and you want to convert back to your original units, if your units are 1/c (see formula "Units" column), then all you need to do is multiply the result by that value. If the units are 1/c^2 all you need to do is multiply by c^2. Energy has units 1/c^2 for example. Velocity has typically 1/c.

	Newton	**Einstein**	**Pi Space Theory (Brady)**	**Units**
Velocity Addition	u + v	u + v / 1 + uv		1/c
Velocity Subtraction	u - v	u - v / 1 – uv		1/c
Kinetic Energy	1/2mv^2		m*(1-Cos(ArcSin(v/c)))*c^2	1/c^2
Relativistic Kinetic Energy		mc^2/Sqrt(1 - v^2/c^2) - mc^2	mc^2 - mc^2*Sqrt(1 - v^2/c^2)	1/c^2
Total Energy		E=MC^2	E = M*Pi*C^2	1/c^2
Potential Energy	mgh		mgh	1/c^2
Velocity for KE=PE	mgh = 1/2mv^2		mgh = m*(1-Cos(ArcSin(v/c)))	1/c
Velocity for PE	v = Sqrt(2*gh)		v = Sin(ArcCos(1-gh/c^2))*c	1/c
Escape Velocity	v= Sqrt(2GMm/r)	Tuv = Guv	v = Sin(ArcCos(1-(GMm/r)/c^2))*c	1/c
Lorentz-Fitzgerald Transformation		Sqrt(1-v^2/c^2)	Cos(ArcSin(v/c))	1/c^2
Time Dilation		t = t' / Sqrt(1-v^2/c^2)	t = t' / Cos(ArcSin(v/c))	1/c
Distance Shortening		x = x' * Sqrt(1-v^2/c^2)	x = x' * Cos(ArcSin(v/c))	1/c^2
De Broglie Wavelength Shortening		(h/mv)*Sqrt(1-v^2/c^2)	(h/mv)*Cos(ArcSin(v/c))	1/c
Radius Excess		planet radius * GM/3c^2	planet radius * GM/c^2	1/c^2
Average Velocity	avg vel = v0 + v / 2		v = vo + v avg vel = (1-Cos(ArcSin(v/c))) / ArcSin(v/c)	1/c
Acceleration	v2 - v1 / t	Metric	(v2 - v1 / t) * gamma	

Gravity	Fg = GMm/r^2	Fg = G’Mm/Pi.r^2	Fg = GMm/r^2 (average acceleration or atom area change - multiply by "gamma" to calculate non-uniform value based on velocity range) Note: Full Pi-Space formula for Gravity is Fg = G’Mm/Pi*r^2 where Pi*r^2 represents the area of the "Planet's Gravity Pi Shell". Typically though Pi is ignored.	1/c^2
Non Uniform Acceleration Calculation "gamma"		Metric	Multiply Newtonian acceleration "a" by gamma value to get adjusted value. Input velocity range v1 to v2 into gamma formula Simple version (gamma measures changing slope of acceleration which is non constant) gamma = (v2 - v1) / (ArcSin(v2) - ArcSin(v1))	
Newtonian Acceleration	accel = v2 - v1 / t		accel = (v2 - v1 / t)*gamma	1/c^2
Distance traveled	s = vt + 1/2at^2		a1 = a * gamma (vo, vo + at) s = vt + (1-Cos(ArcSin(a1*t/c))/(ArcSin(a1*t/c))	1/c^2
Final velocity of falling object	v^2f = v^2o + 2ax		a1 = a * gamma (vo, vo + ax) vf = vo + Sin(ArcCos(1-(a1*x)/c^2))	1/c

Distance travelled at final velocity	h = vf^2/2g		g1 = g * gamma (vo, vf) h = (1 - (Cos(ArcSin(vf/c))) / (g1/c^2)	1/c^2
Solving for time t	See [1] below		Use Mathematica to solve for t, See [1] below	1/c
Black Hole Radius	r = 2GM/c^2		r = GM/c^2	1/c

	Bernoulli	**Pi-Space**	
Pitot - Velocity from Pressure	v=Sqrt(2*(Pt-Ps)/Rho)	v=Cos(ArcSin(1 – ((Pt-Ps/Rho)/c^2))*c	1/c
Venturi - Q - Flow	Q=A1*Sqrt(2*(Pt-Ps)/(Rho*(1-(A1/A2)^2))	Q=A1* Cos(ArcSin(1 – ((Pt-Ps/(Rho*(1-(A1/A2)^2)/c^2))*c	1/c

Navier Stokes In Pi-Space

Flow e.g. xy area/energy (See Quantum Theory Doc)

$$\frac{\partial u}{\partial t} = \mu * \left(Cos\left(ArcSin\left(\frac{v}{c}\right)\right)\Psi(r,t) - \Psi(r,t) \right) + \frac{\left(\frac{p}{\rho}\right)}{c^2}\Psi(r,t) + \frac{\left(\frac{GM}{r^2}\right)h}{c^2}\Psi(r,t) + k\frac{(\nabla T)}{c^2}\Psi(r,t)$$

Navier Stokes Solving For Velocity (See Quantum Theory Doc)

For xy,yz and zx axis e.g.

$$FlowVelocity_{xy} = Sin\left(ArcCos\left(1 - \frac{\left(\frac{p}{\mu\rho}\right)}{c^2} - \frac{\frac{gh}{\mu}}{c^2} - \frac{\frac{k}{\mu}(\nabla T)}{c^2} - \frac{ExtTurb}{c^2} \right)\right) * c$$

Simple Harmonic Motion, Solving For Velocity knowing Amplitude, x, Spring constant k and mass m (See Advanced Quantum Theory Doc)

$$v = \sqrt{\frac{k}{m}}\left(Cos\left(ArcSin\left(1 - \left(\frac{1}{2}\frac{A^2}{c^2} - \frac{1}{2}\frac{x^2}{c^2} \right)\right)\right) * c \right)$$

Average Transverse Kinetic Energy Due To Temperature, solving for velocity

$$v = Cos\left(ArcSin\left(1 - \frac{\frac{3}{2}\frac{kT}{m}}{c^2}\right)\right) * c$$

[1]

$$t = \frac{v_{0y}}{g} \pm \sqrt{\frac{v_{0y}^2}{g^2} - \frac{2h}{g}}$$

Solve[v*t + ((1-Cos[ArcSin[a]])/(ArcSin[a]))*(t*t) == s,t]¶

¶

$$\left\{\left\{t \to \frac{-v\,ArcSin[a] - \sqrt{4\,s\,ArcSin[a] - 4\sqrt{1-a^2}\,s\,ArcSin[a] + v^2\,ArcSin[a]^2}}{2\left(1-\sqrt{1-a^2}\right)}\right\},\left\{t \to \frac{-v\,ArcSin[a] + \sqrt{4\,s\,ArcSin[a] - 4\sqrt{1-a^2}\,s\,ArcSin[a] + v^2\,ArcSin[a]^2}}{2\left(1-\sqrt{1-a^2}\right)}\right\}\right\}$$

How the properties are mapped to the atom using the theory

Pi-Space units are v/c (atom diameter line change) and g/c^2 (atom area change) relative to Observer

Atom area is proportional to the atom diameter squared

Atom time clock tick t is proportional to the atom diameter and time t squared is proportional to the area of the atom

Atom distance s travelled is proportional to the area of the atom

Velocity which is distance over time represents area divided by diameter which produces an atom diameter value

Speed divided by distance over time squared is an atom area calculation

Energy is an atom area calculation

Cosine models compression of an atom. Sine models non-compression. Movement represents compression.

Core Pi Space Math Ideas

Formula	**Existing**	**Pi Space**
Sphere addition	c^2 = a^2 + b^2	Pi*c^2 = Pi*a^2 + Pi*b^2

Atom Area		Pi*d^2
Diameter size of Observer atom	C	1
Atom diameter loss due to movement	Velocity	Sin(ArcSin(v/c)) = v/c
Remaining diameter due to movement	Lorentz-Fitz	Cos(ArcSin(v/c))
General movement equation, Law of the Cosines	c^2 = a^2 + b^2 + 2abCos(Theta)	Pi.c^2 = Pi.a^2 + Pi.b^2 + 2.Pi.a.b.Cos(Theta)
General angle equation for interacting atoms, Law of the Sines	a/Sin(a) = b/Sin(b) = c/Sin(c)	a/Sin(a) = b/Sin(b) = c/Sin(c)
Range of velocities	0..C	0..ArcSin(v/c))