Theory of Everything (Interference Theory)

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Theory of Everything

Phenomena	Theory	
Electromagnetism	Electroweak Unified Theory	**Theory of Everything (ToE)**
Weak Force		
Strong Force	Quantum Chromodynamics	
Gravity	General Theory of Relativity	
Mass	Higgs Mechanism	
Interference	Quantum Theory	

A theory that unifies the four forces is sometimes called the theory of everything, but forces alone cannot explain all physical phenomena.
The mass of particle is determined independently of the forces, but with the Standard Model, it cannot be determined without actual measurement.
Wave-like behavior and interference are only expressed as mathematical formulas, and we do not fully understand why this happens.
In this video, we introduce a theory that treats not only forces but also mass and interference in a unified manner.

Candidate Theory of Everything

	Standard Theory	Super String Theory		**Interference Theory**
Particle	Point	String	Membrane	3-Dimensional
Particle Dimension	0	1	2	3
Space Dimension	3	≧10		3
Time Dimension	1	1		1
Free Parameter	≧19	≧1		≧0

One candidate for the theory of everything is superstring theory.
However, it would be difficult to come up with a rational explanation for why there are 10 dimensions, without assuming that God decided it.
If 10 dimensions are required for strings, it would be better to aim for a rational explanation in three dimensions without assuming a string.
If we consider a three-dimensional solid to exist within a three-dimensional space, there is no need to assume invisible dimensions.

Type of Forces

Types of Forces = Types of overlapping waves

Electromagnetism	Overlapping sphere with anothers
Weak Force	Overlapping with self changed direction
Strong Force	Overlapping with self after rotation
Gravity	Overlapping cross sections with anothers
Mass	Overlapping with self after translation
Intereference	Overlapping with self after passing another path

The approach to unifying the four forces, mass, and interference interprets all of these as the result of interference.
When waves overlap, they interfere, but there is more than one situation in which waves can overlap.
For example, when waves overlap as a result of translation or rotation, it is considered that a different force is at work in each case.
The number of types of forces that exist is not decided by God, but by geometric degrees of freedom.

Strength of Forces

Strength of Forces ＝ Degree of wave overlapping

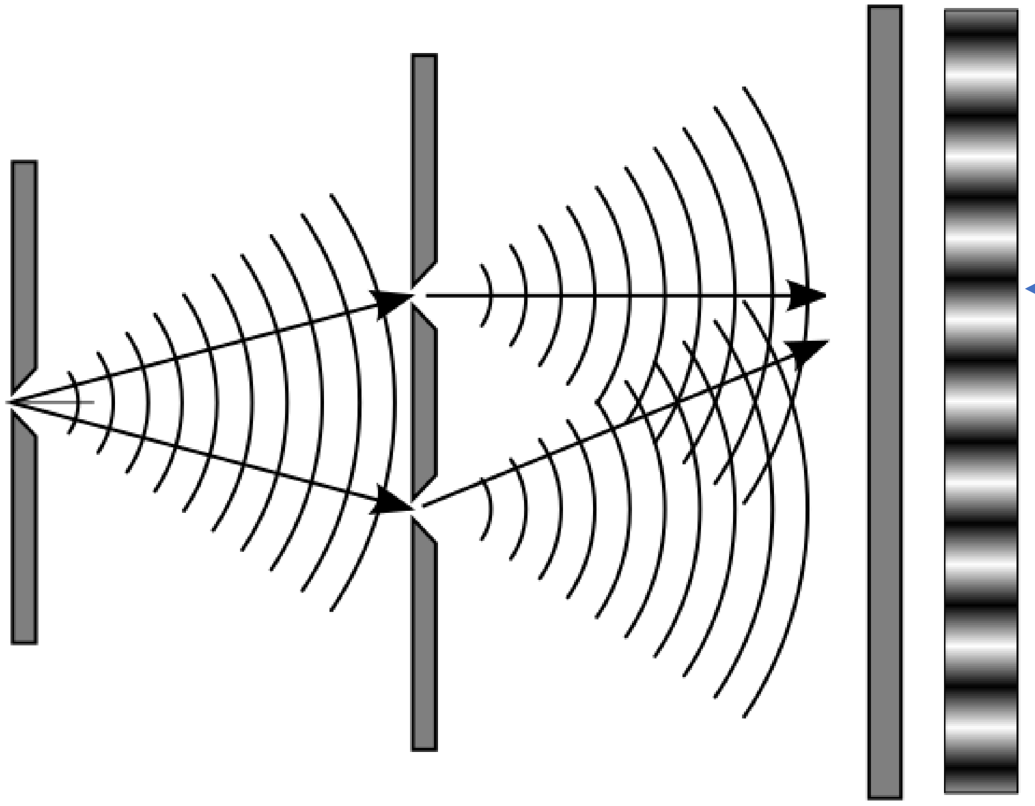
0 ≦ g (Gauge coupling constant) ≦ 1

g = 0	Waves do not overlap at all
g = 1	Waves are completely overlapping in phase
	Waves are completely overlapping in antiphase (Probability of particle existence: 0)

Direction of Forces ＝ The direction in which the probability of particle existence increases (avoiding overlapping in antiphase)

Generally, the strength of the force is expressed by the gauge coupling constant.
The strength of the force is not decided by God, but by the degree to which the waves overlap.
When the waves overlap in anti-phase, the probability of the particle's existence is 0.
The force avoids anti-phase overlap and acts in the direction that increases the probability of the particle's existence.
We will explain each of the four forces, mass, and interference in detail.

Double slit experiment



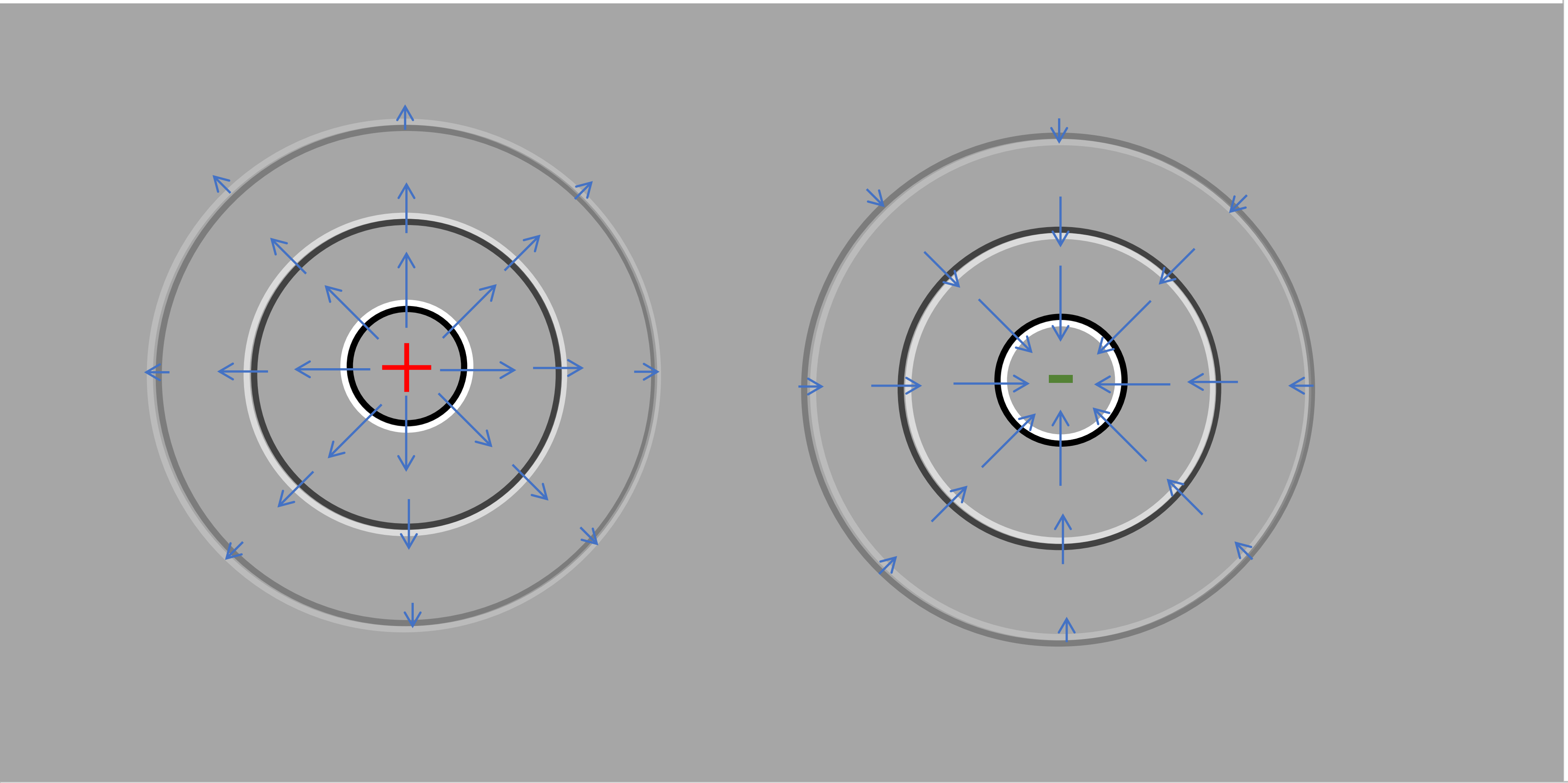
Wave amplitude: 0

Probability of existence: 0

Not the repulsive force

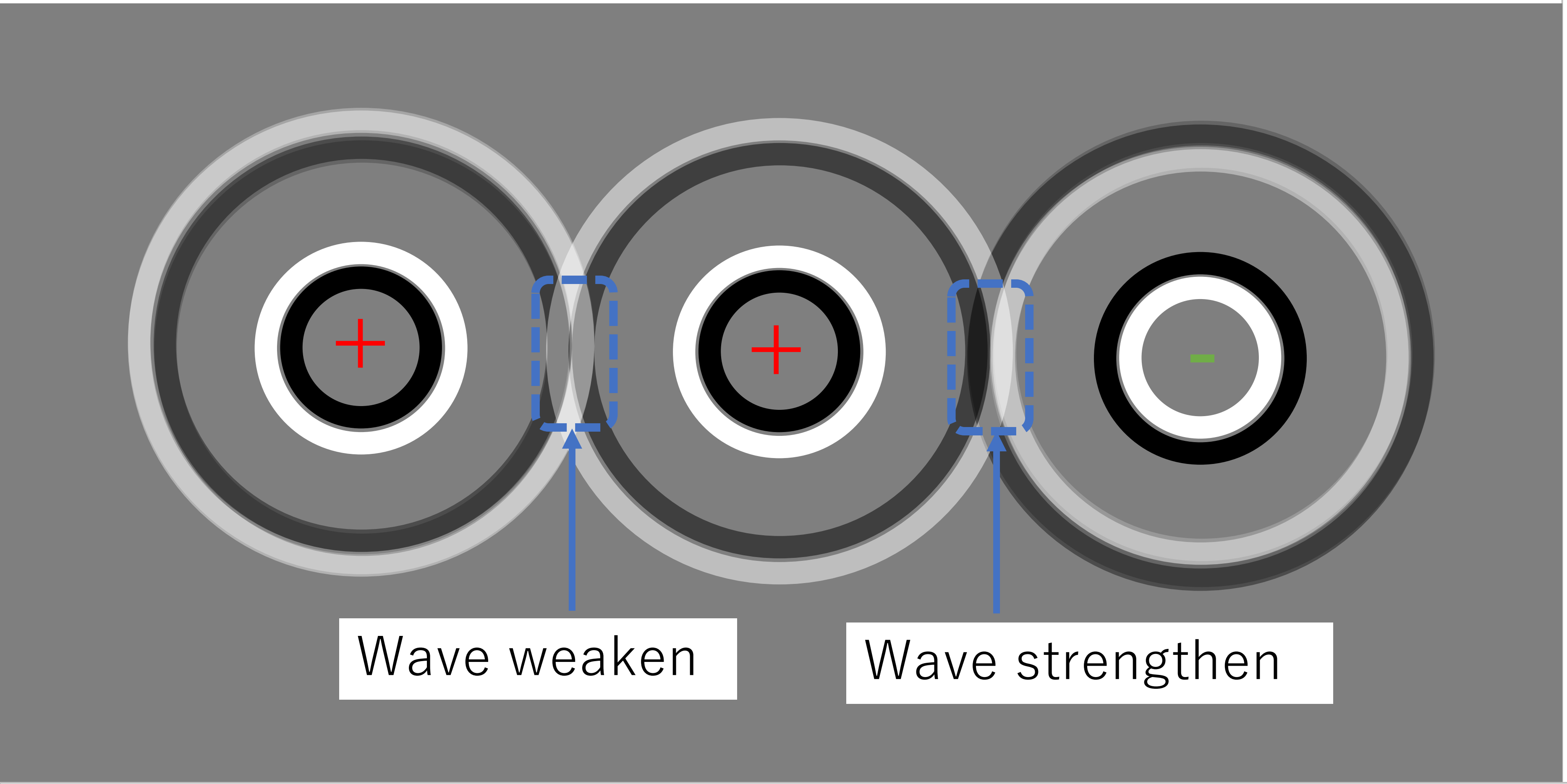
First, let's explain interference in a typical double slit experiment.
When the path is an integer multiple of the wavelength, the waves reinforce each other, but if it is shifted by half a wavelength, they destructively.
The black parts of the stripes are the parts where the waves weaken each other.
This is not because repulsive force is at work and those areas are avoided.
Because particles are also waves, if the amplitude is 0, the probability of existence is also 0.

Electric field



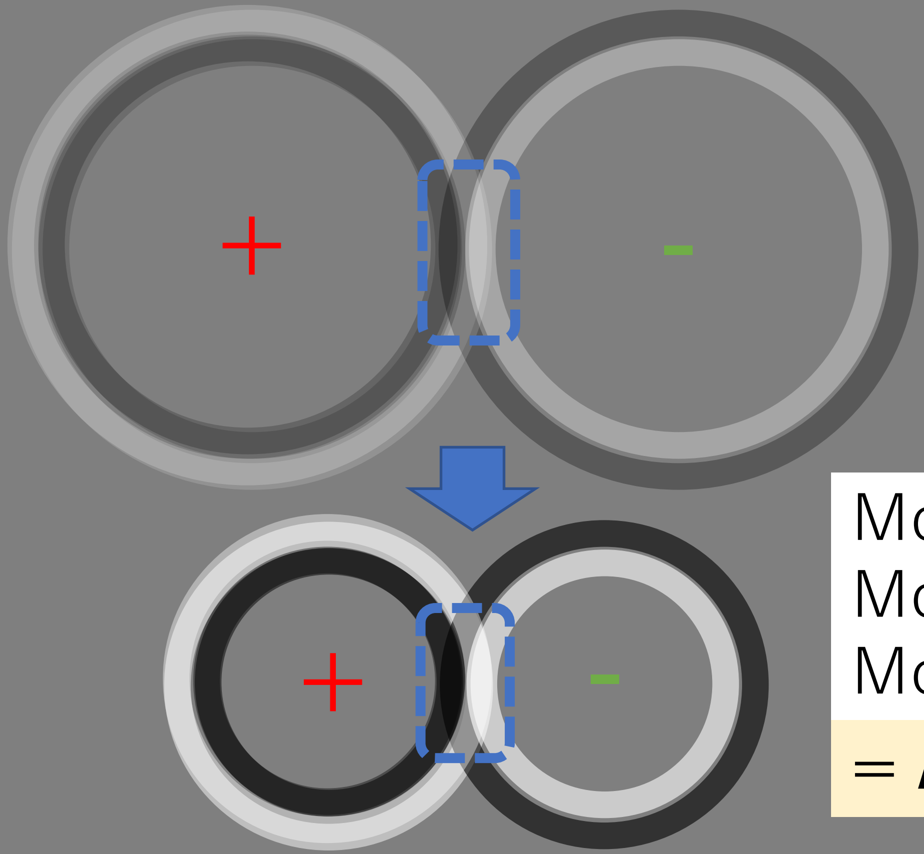
We attempt to interpret the attractive and repulsive forces acting between electric charges as the result of interference.
The electric field is something that radiates in a spherical shape around the charge and decays with distance.
In the schematic diagram, the inside and outside of the sphere are colored white and black.
The colors for + and - are reversed.

Electric field interference



Consider what happens when the spheres emitted from two electric charges overlap.
When + and + spheres come into contact, white and black overlap and cancel each other out.
When + and - spheres come into contact, the same colors overlap and reinforce each other.
If the colors represent the sign or phase of the wave, then this is interference.
However, interference alone changes the probability of existence, and does not result in attractive or repulsive forces.

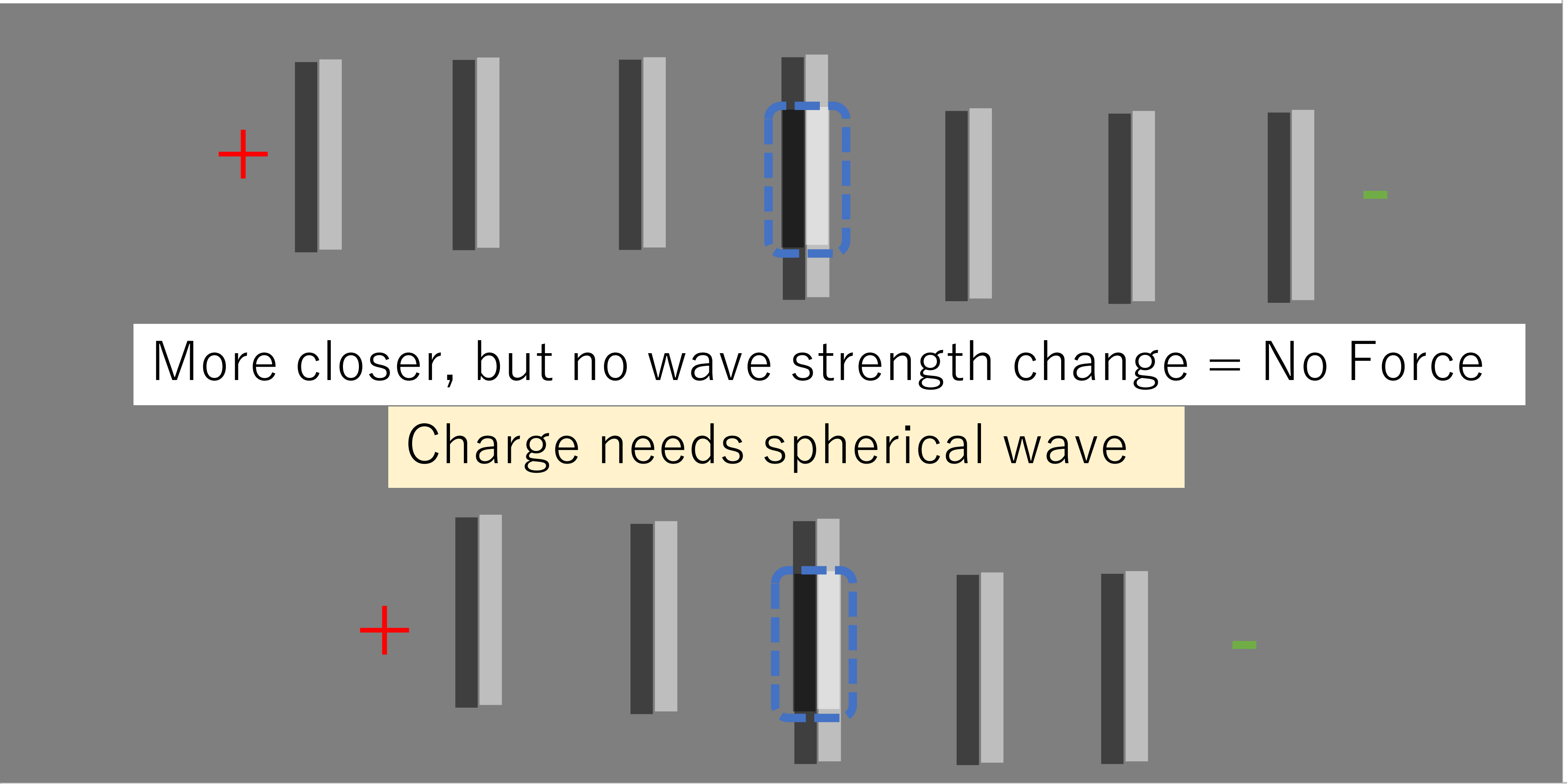
Electric attractive force



More closer,
More strengthen,
More existence
= **Attractive force**

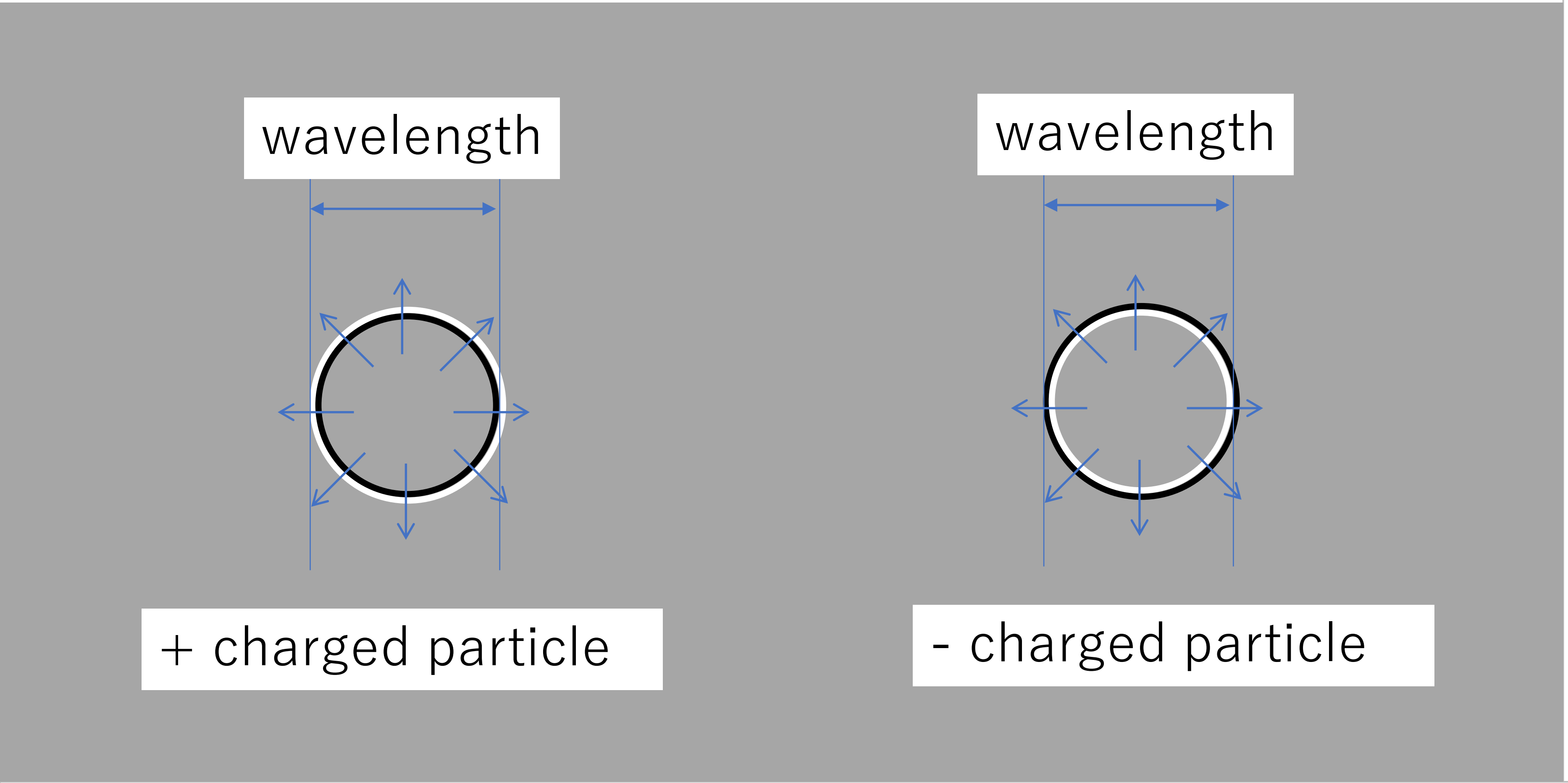
Electric fields attenuate with distance, and interference becomes weaker.
Charges of opposite sign interfere more strongly the closer they are, increasing their probability of existence, so they move closer together.
Charges of the same sign move away from each other.
This is easier to understand intuitively than the force explanation of gauge particles playing catch.
Photons act as an intermediary to allow distant particles to interfere with each other.

Parallel wave interference



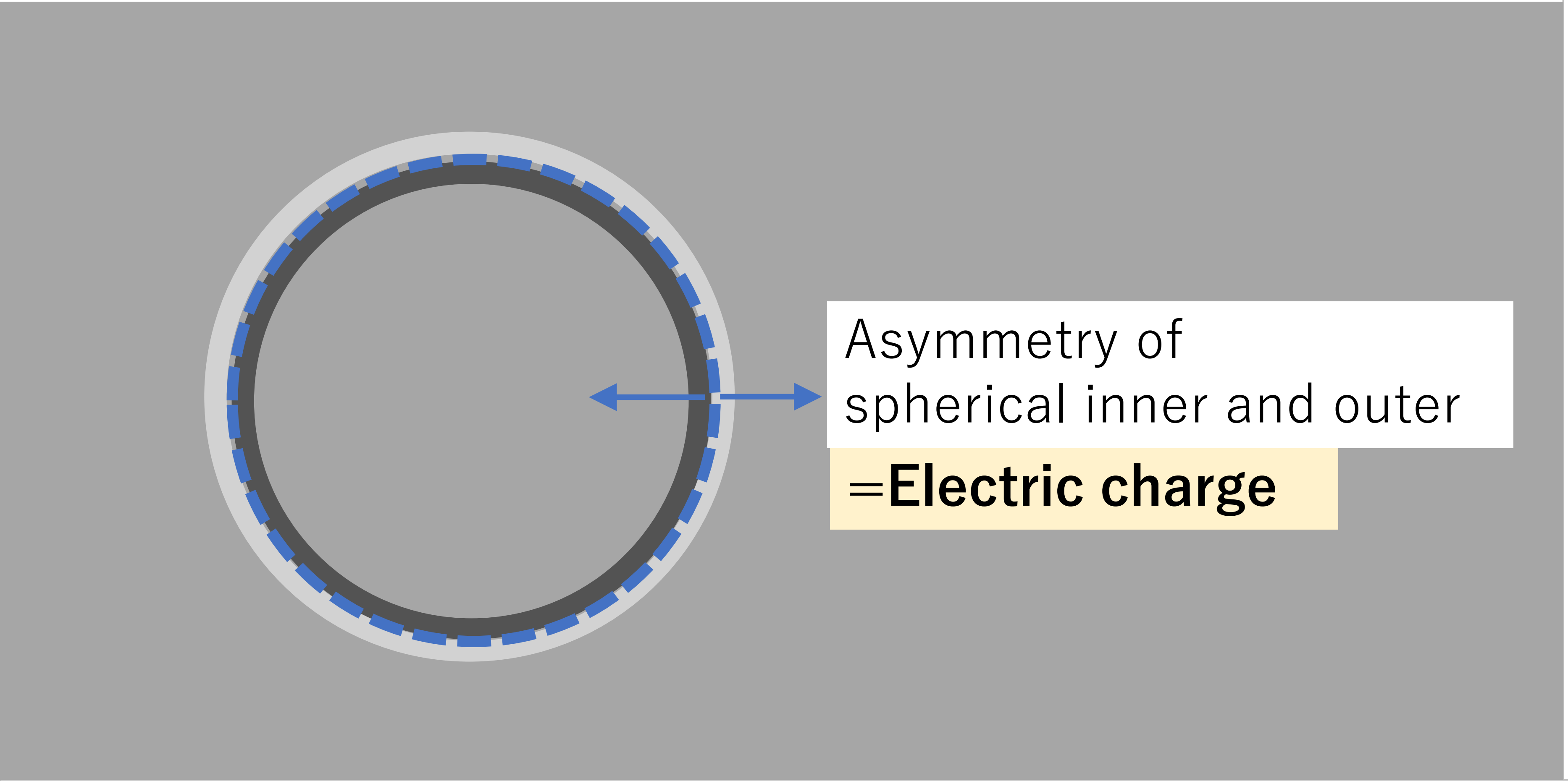
Let's consider a case where a planar wave simply moves in a parallel motion and does not attenuate.
Since the strength of interference does not change even if the distance changes, no attractive or repulsive forces act.
To function as an electric charge, the wave needs to spread out spherically.

Schema of charged particle



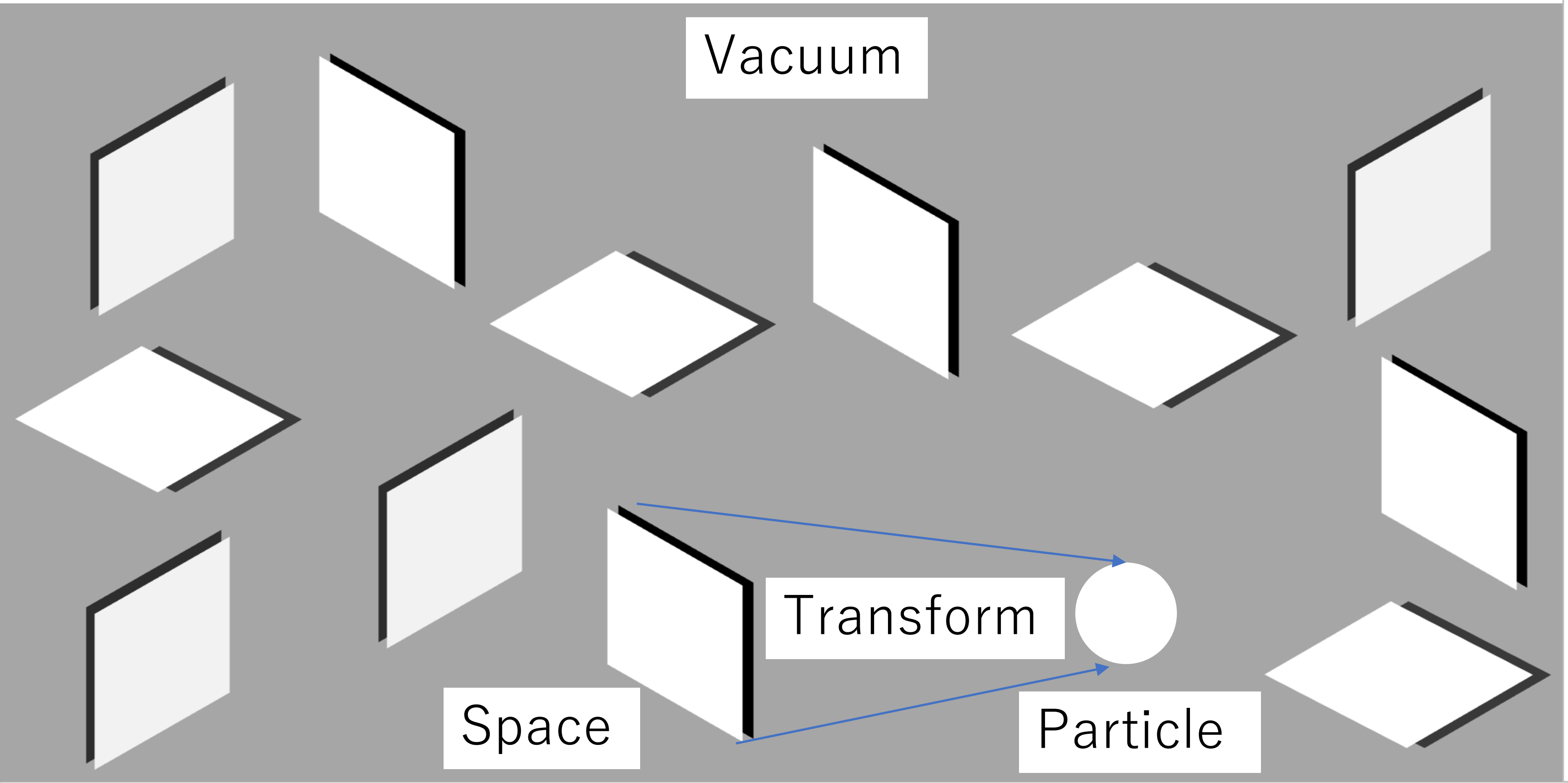
Let's represent a charged particle using a schematic diagram.
Since a particle is a point but also a wave with a spread of about a wavelength, it is represented by a sphere whose wavelength is its diameter.
The front and back of a surface are always white and black.
There are no actual surfaces; they simply represent vectors from black to white.

Electric charge



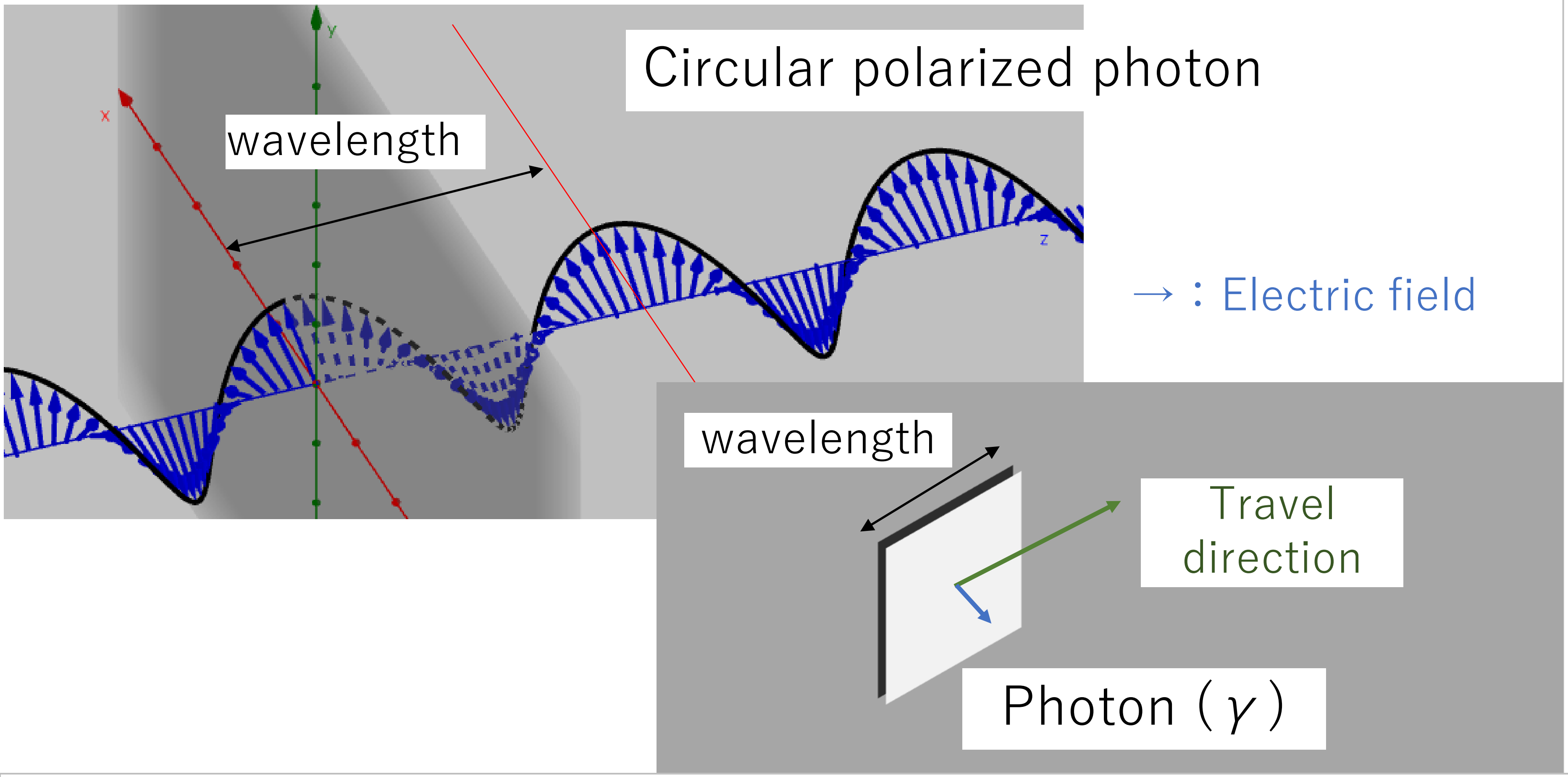
The charge corresponds to the magnitude of asymmetry between the inside and outside of the sphere.
The colors of the inside and outside of the sphere determine the sign of the charge.
A flat surface has an indistinguishable inside and outside and is symmetric, so the charge is 0.
For a hemisphere the charge is 1/2, and for a full sphere it is 1.

Space and particle



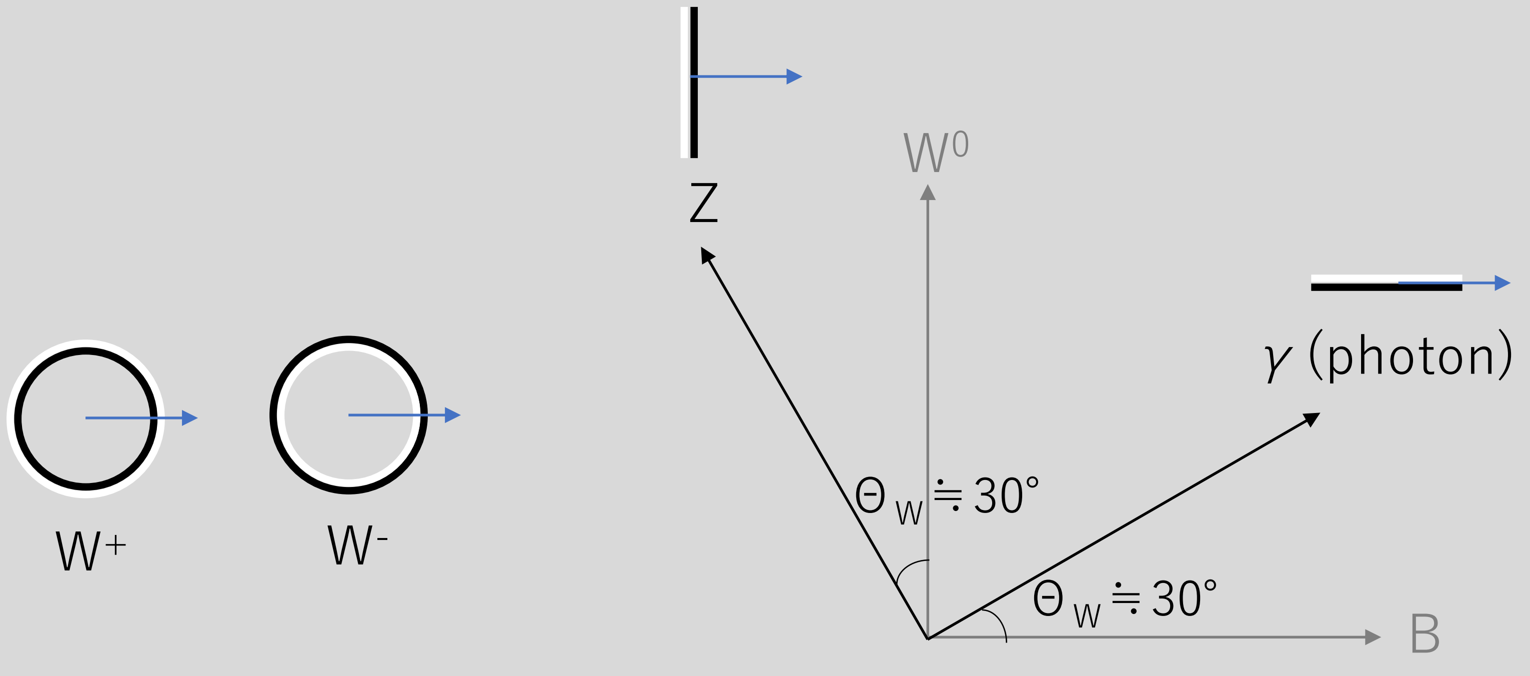
First, let's think about what vectors white and black represent.
It's fine to think of them as simply spatial directions, rather than the direction of something special.
Since space exists in a vacuum, you can think of it as filled with orthogonal planes.
Since they are not spherical, no attractive or repulsive forces act when they interfere with each other.
A charged particle is a plane in a vacuum that curved into a sphere.
A particle is not something special that is not a vacuum, it is simply a change in the properties of space.

Schema of photon



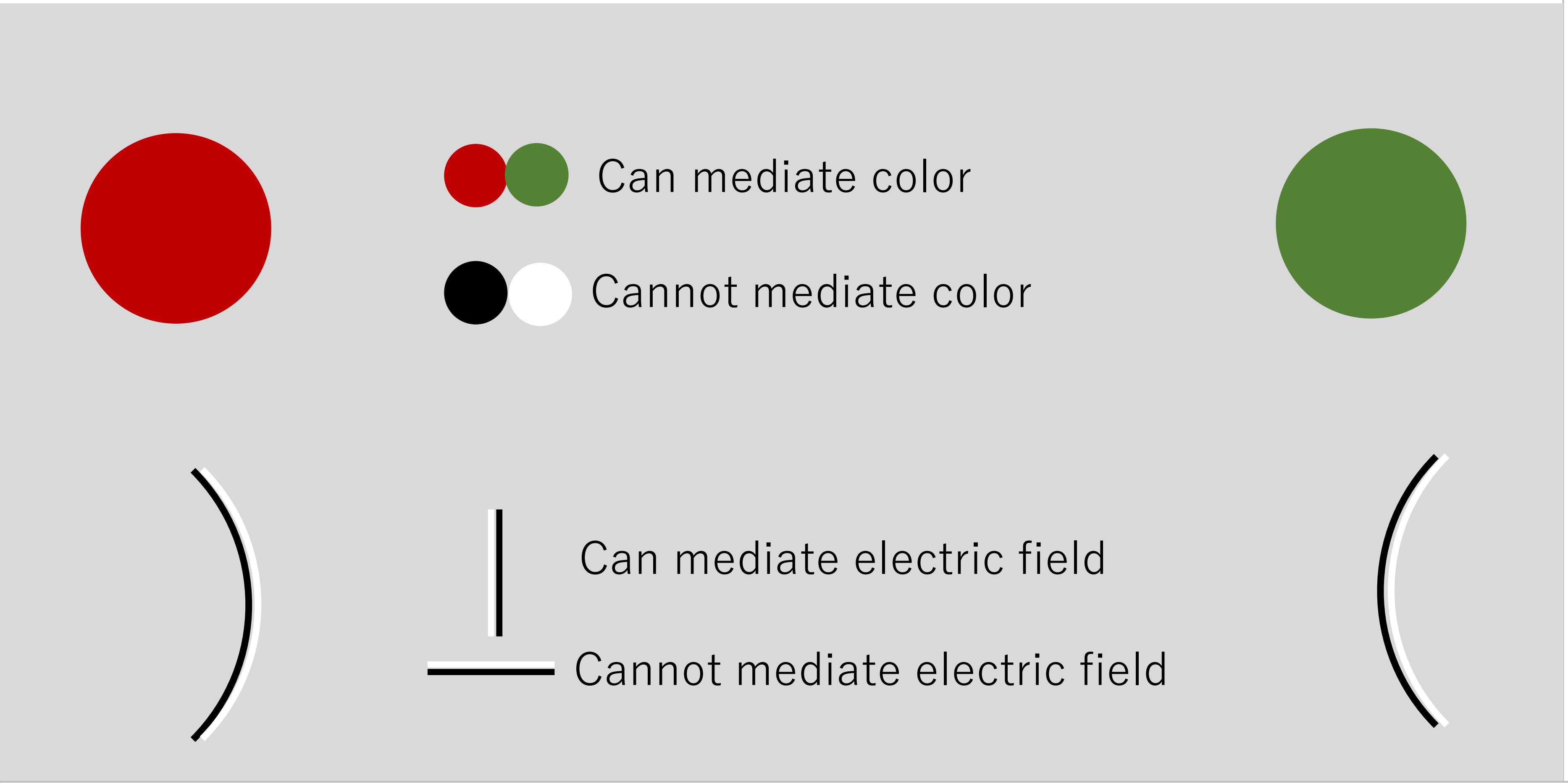
Let's consider a schematic diagram of a photon.
Photons are particles, but they are also electromagnetic fields.
There is an electric field vector in a direction perpendicular to the photon's direction of travel.
If the electric field vector were represented as a surface, it would be a plane perpendicular to the direction of travel.
With circularly polarized light, the direction of the electric field makes one revolution around the direction of travel in one wavelength.
As it is not a sphere, the photon itself does not have an electric charge.

Schema of weak boson



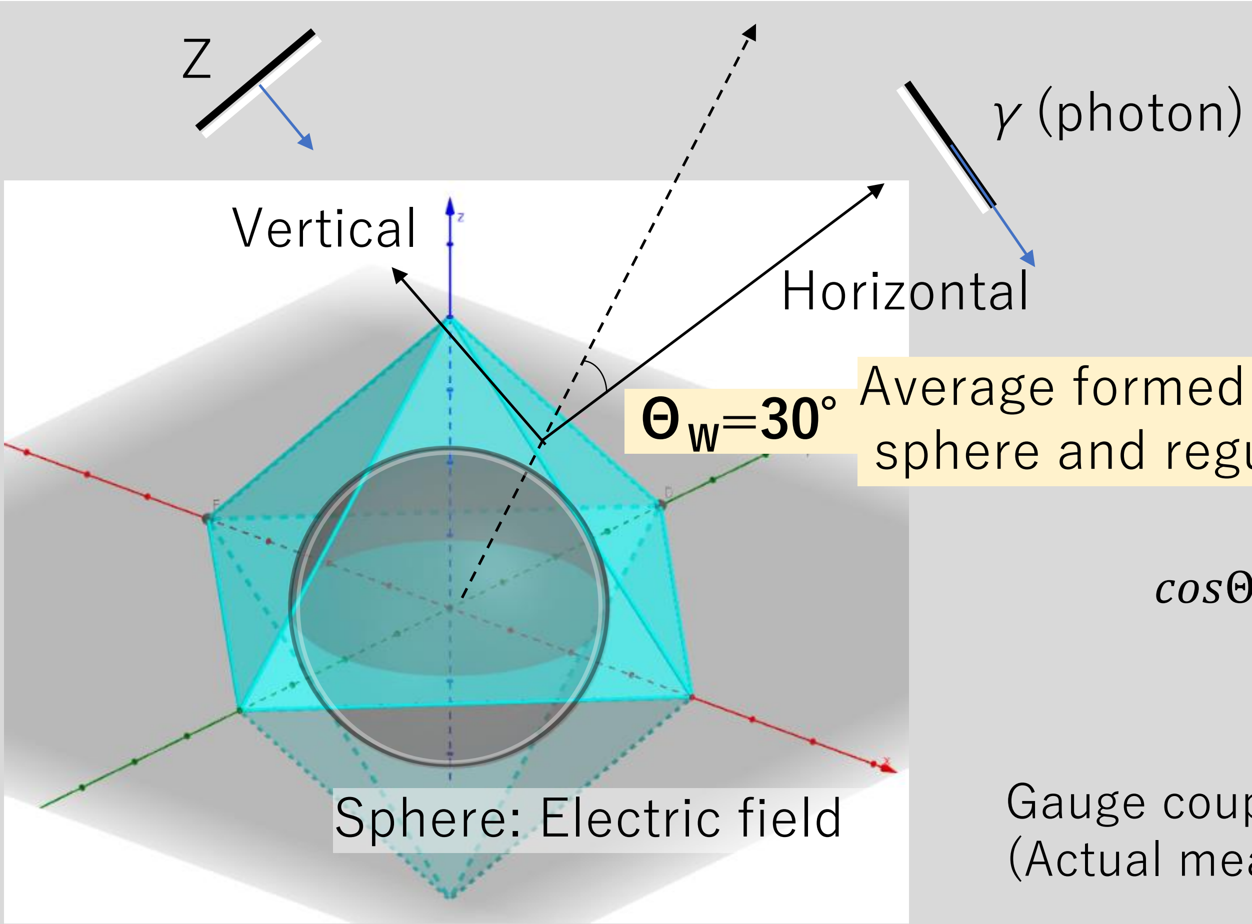
Next, we will consider the interpretation of the electroweak unified theory.
Gauge particles called W+ and W- bosons, which have a charge of ±1, appear.
The photon and Z boson appear as particles that have no charge.
It is thought that what was originally a W0 and B boson mixed together to become the photon and Z boson.
They mix at an electroweak mixing angle of about 30 degrees.
The photon and Z boson are orthogonal to each other.
Similarly, in the schematic diagram, the Z boson is drawn perpendicular to the photon.
If the photon is a transverse electromagnetic wave, the Z boson is predicted to mediate longitudinal waves.
As for the W boson, since it is a charged particle, it is represented as a sphere.

What is needed for intermediation



Now, let's think about what properties a particle that mediates force needs to have.
In order to mediate something, it needs to possess that something.
For example, to mediate color, it needs to have color.
To mediate an electric field in a certain direction, it needs to have an electric field in the same direction.

Electroweak mixing angle



Average formed angle between sphere and regular octahedron

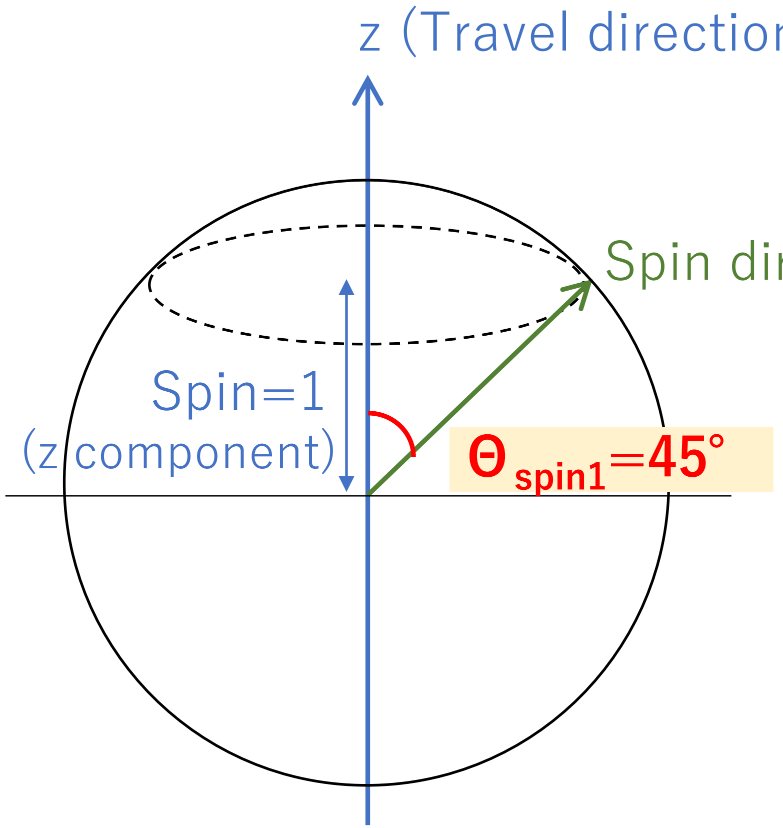
$$cos\Theta_W = cos30° = \frac{\sqrt{3}}{2} = 0.866$$

No match

Gauge coupling constant (Actual measurements) $e = 0.303$

We will explain geometrically why the electroweak mixing angle is about 30 degrees.
To mediate the electric field represented by a sphere, the gauge particles also need to have faces facing the same direction.
However, since both photons and Z bosons are flat, they cannot be arranged smoothly around the sphere.
As shown in the image, the average angle between the sphere and the regular octahedron is 30 degrees.
Only the cosine component horizontal to the surface is mediated by the photon.
The sine component perpendicular to the surface is mediated by the Z boson.
The fact that the force can only be partially mediated means that the gauge coupling constant is small.
A cosine of 30 degrees does not match the measured gauge coupling constant for photons.
There must be other reasons why the force can only be partially mediated.

Force attenuation by spin1



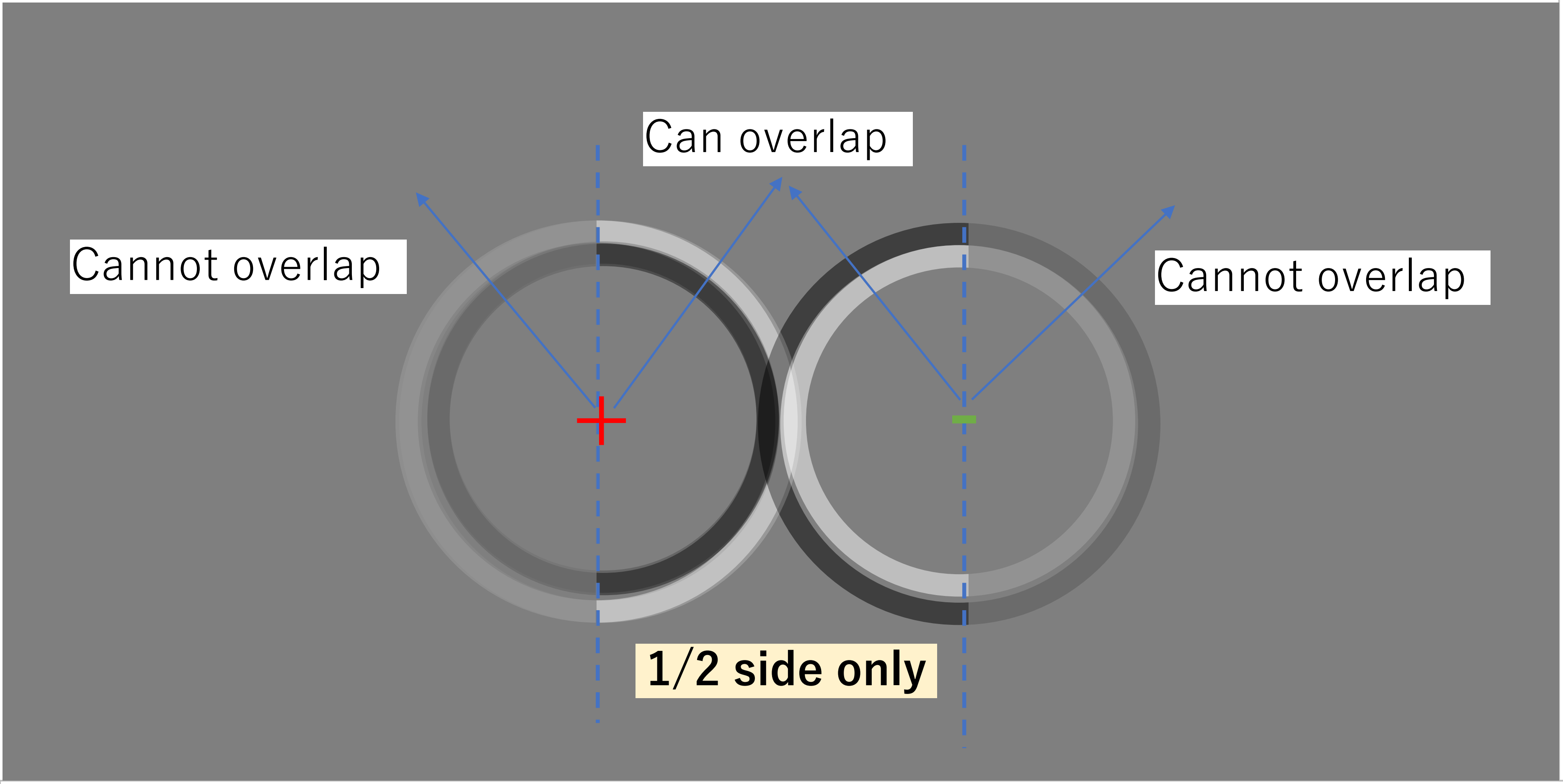
$$\frac{1}{\sqrt{1(1+1)}} = \frac{1}{\sqrt{2}}$$

$$cos\Theta_{spin1} = \frac{1}{\sqrt{1(1+1)}} = \frac{1}{\sqrt{2}}$$

$$= 0.707$$

Let's consider the attenuation of force due to the spin of particles.
All gauge particles other than gravitons have a spin of 1.
When the spin is 1, the spin axis is tilted at an average of 45 degrees from the direction of travel.
We assume that the direction of the photon's electric field is perpendicular to the spin axis, not the direction of travel.
In that case, because it is tilted, only the cosine 45-degree component of the force can be mediated.

Force attenuation by remote mediate



Let's consider again the case of two electric fields interfering with each other.
If the particle is divided in half, the facing waves can overlap.
The opposite halves cannot overlap.
Therefore, only half of the force is mediated.
The same is true for other forces when interacting with an unspecified number of particles at a distance.

Fine structure constant

Electromagnetic gauge coupling constant

Half-side Spin1 Sphere horizontal

(Theoretical value) $e' = \frac{1}{2} \times cos45° \times cos30° = \frac{1}{2} \times \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} = \sqrt{\frac{3}{32}} = 0.306$

(Actual measurements) $e = \sqrt{4\pi\alpha} = 0.303$

Fine structure constant

(Theoretical value) $\alpha' = \frac{e'^2}{4\pi} = \frac{3}{128\pi} = 1/134$

(Actual measurements) $\alpha = 1/137$

We calculate the theoretical value of the electromagnetic gauge coupling constant.
The three damping rates of half-side, spin1, and sphere horizontal are multiplied together.
A value close to the actual measured value is obtained.
This value can be converted to the fine structure constant.
The fine structure constant was also obtained to be close to the measured value.

Coupling constant of Z and charge

Gauge coupling constant of Z boson and charge

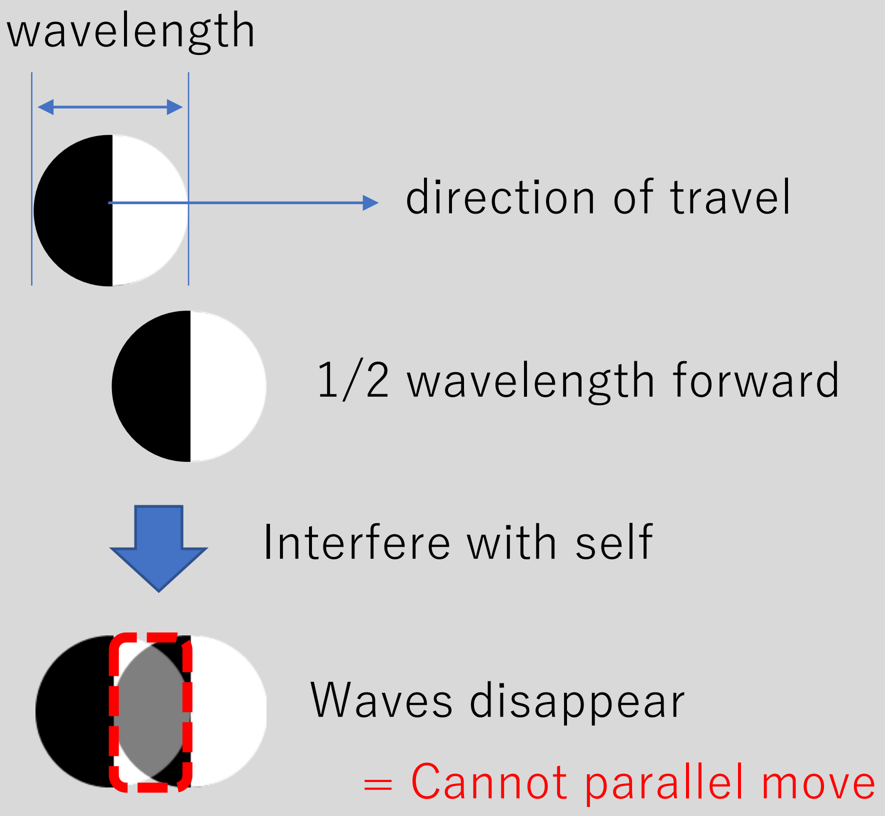
Half-side Spin1 Sphere **Vertical**

(Theoretical value) $\frac{1}{2} \times cos45° \times \boldsymbol{sin}30° = \frac{1}{2} \times \frac{1}{\sqrt{2}} \times \frac{1}{2} = \frac{1}{4\sqrt{2}} = 0.177$

(Actual measurements) $\sqrt{g^2 + g'^2} \sin^2 \Theta_W = g' sin\Theta_W = 0.166$

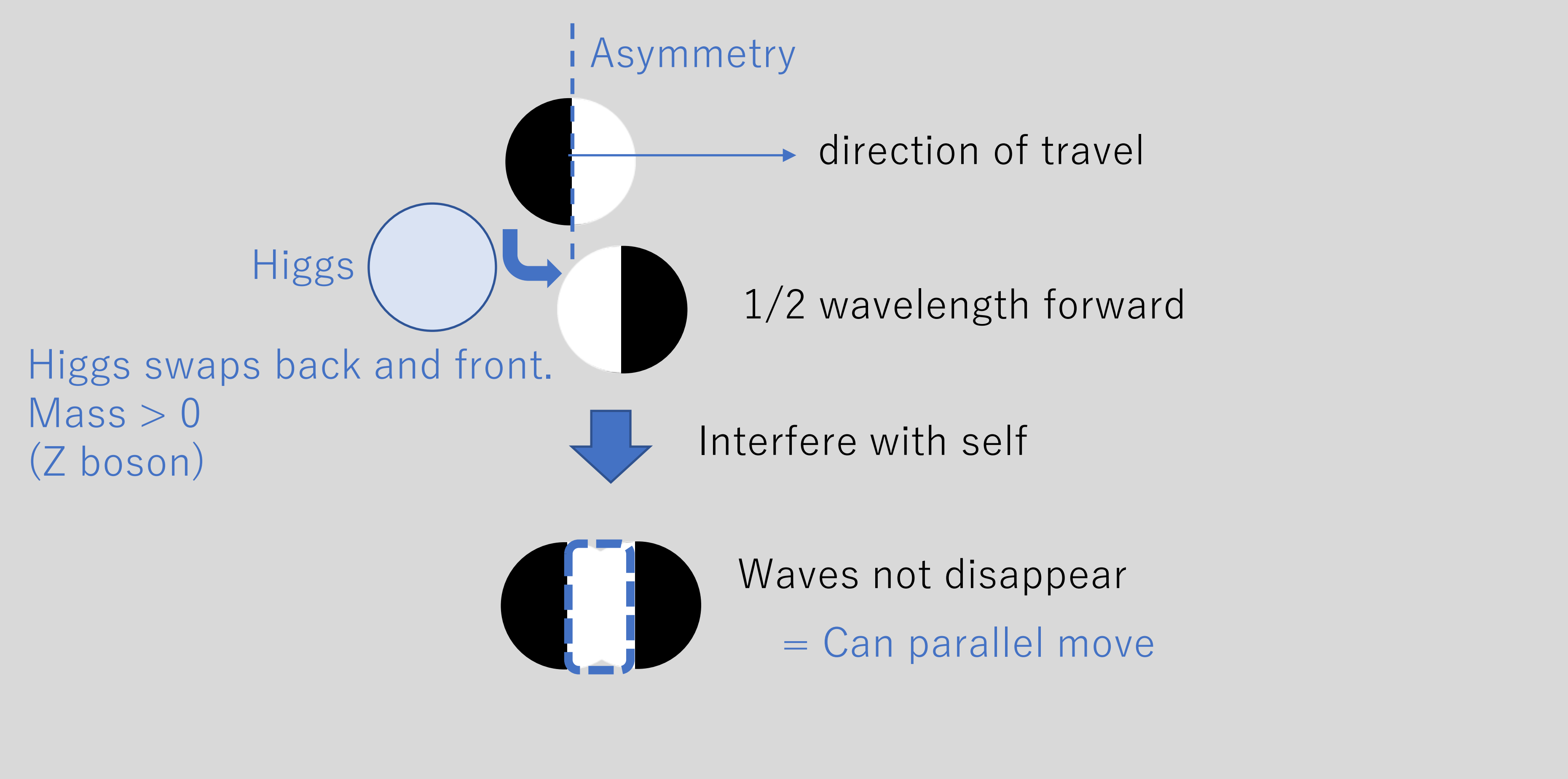
Similarly, we calculate the gauge coupling constant between the Z boson and an electric charge.
All we have to do is change the cosine of 30 degrees in the case of a photon to sine of 30 degrees.
We get a value that is close to the measured value.
The Z boson also interacts with the weak force, but this is the value when it interacts with an electric charge.

Rest mass



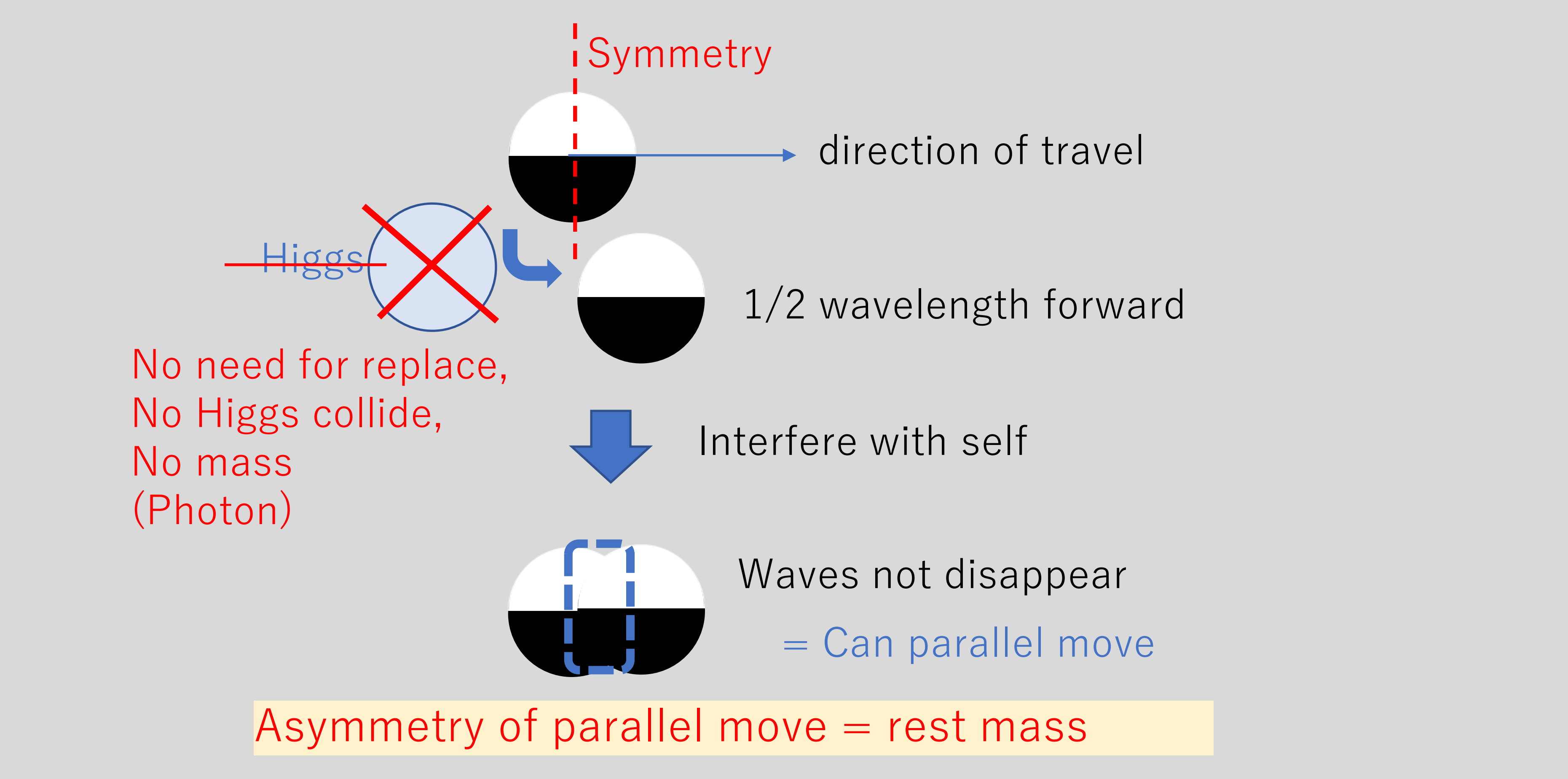
Next, let's consider rest mass as the result of interference.
In the Standard Model, mass is achieved when a particle collides with a Higgs particle.
As shown in the diagram, consider the case where a particle has traveled half a wavelength.
If it were to interfere with itself, which was half a wavelength ahead, the interference would cause the waves to disappear.
For this reason, particles are not permitted to move in parallel.

Massive particle



What can be done to ensure that the waves do not disappear?
If the Higgs particle swaps its front and back sides, the waves will not disappear.
In the Standard Model, the Higgs particle swaps its right-handed and left-handed nature.
If swapping the front and back results in a mirror image, there is no contradiction to the Standard Model.
Particles that are asymmetric in the direction of travel, such as the Z boson, have mass.

Massless particle



Let's also consider what happens if the particle is rotated 90 degrees.
Since it is originally symmetrical in the direction of travel, there is no need to swap it back and forth.
In other words, there is no need for it to collide with the Higgs particle.
Particles that are symmetrical in the direction of travel, such as photons, do not have mass.
The size of the rest mass comes from its asymmetry with respect to motion in the direction of travel.

What is need for Higgs

Parallel move asymmetry — $a = 1$ (Max)

Higgs particle mass — $M_H = 125 GeV/c^2$ (Most heavy)

Spin — $J = 0$ (No direction)

2 types
- H — Phase - → +
- $\bar{H}$ — Phase + → -

Let's consider the properties necessary for the Higgs particle.
The Higgs itself is asymmetric to mediate the asymmetry with respect to parallel translation.
The Higgs particle needs to be completely antisymmetric.
If the asymmetry is insufficient, the phase exchange will be insufficient and it will partially disappear.
The Higgs particle is predicted to be the most asymmetric and heaviest particle.
The Higgs particle also has a spin of 0, meaning it has no direction.
Therefore, changing its direction does not reverse its properties.
It is predicted that there are two types: those that change the phase from positive to negative, and negative to positive.

Coupling constant and Asymmetry

Gauge coupling constant

(0≦g≦1)

Strength of force

$$g_x = a_x$$

Phase asymmetry

(0≦a≦1)

0: Symmetric
1: Antisymmetric

The electromagnetic force and mass explained so far each correspond to a different symmetry.
We predict that the gauge coupling constant is equal to the magnitude of the asymmetry corresponding to that force.
The asymmetry has a maximum value of 1 when antisymmetric.
The gauge coupling constant is also constrained to have a maximum value of 1.

Energy and Asymmetry

Higgs particle mass

M_H=125GeV/c^2 (Actual measurement)

Energy $$E_x = a_x M_H c^2$$ Natural unit

a_x: Phase asymmetry

($0 \leqq a \leqq 1$)

x: Force type

Energy = Asymmetry

The asymmetry of the Higgs particle is 1, and its mass has been measured.
This mass can be interpreted as a coefficient that converts asymmetry to mass.
Multiplying it by the speed of light gives the formula for converting asymmetry to energy.
This mass and the speed of light are simply natural units for converting physical quantities.
This formula asserts that asymmetry and energy are equivalent.
The existence of energy means that something is asymmetric.
If there was energy at the beginning of the universe, then something was asymmetric from the beginning.

Weak boson mass

Mass $M_X = a_X M_H$

a_x : Particle's asymmetry of parallel move

M_x : Higgs mass = 125.2GeV/c^2

Z boson mass

Spin1

$$M_Z{}' = \cos 45° \times M_H = \frac{1}{\sqrt{2}} M_H = 88.5 GeV/c^2 \text{ (Theoretical)}$$

$$M_Z = 91.2 GeV/c^2 \text{ (Measured)}$$

$W^{\pm}$ boson mass

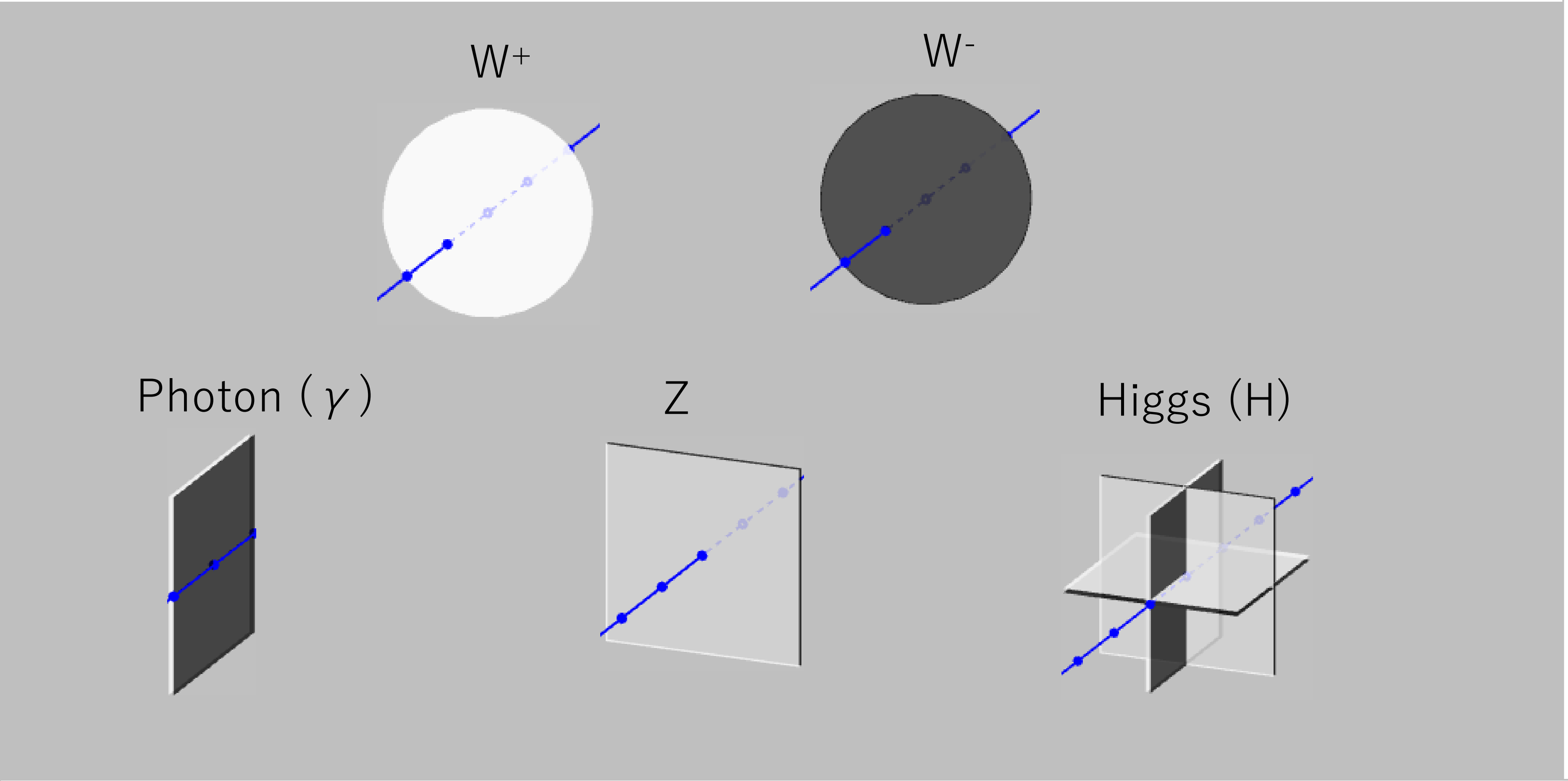
Spin1 Sphere horizontal

$$M_W{}' = \cos 45° \times \cos 30° \times M_H = \sqrt{\frac{3}{8}} M_H = 76.7 GeV/c^2 \text{ (Theoretical)}$$

$$M_W = 80.4 GeV/c^2 \text{ (Measured)}$$

The mass can also be calculated from asymmetry.
The Z boson has spin 1, so it is tilted by 45 degrees.
This makes it lighter than the Higgs boson by the cosine of 45 degrees.
The W boson is a sphere because it has an electric charge.
The sphere is tilted by 30 degrees from the plane.
This makes it a further lighter than the Z boson by the cosine of 30 degrees.
Both values are close to the actual measured values.
The relationship between W and Z is a cosine, just like the Standard Model.

Schema of electroweak boson



Here is a schematic diagram of bosons related to the electroweak force.
The W boson is a sphere, and the others are flat.
Like the Z boson, the asymmetry in the direction of travel determines the mass.
The Higgs particle has spin 0, so it has the same asymmetry when viewed from any direction.
The Higgs corresponds to three orthogonal planes.
For example, when viewed from a 45-degree position, each of the two planes is responsible for half the asymmetry.
In total, the asymmetry is 1 no matter what direction you look at it from.

Fermion charge (Standard model)

Charge		(Weak) Isospin		Hypercharge
Q	$=$	T	$+$	Y

Q:
- $\pm\frac{1}{3}$ d (quark)
- $\pm\frac{2}{3}$ u (quark)
- ± 1 e (electron)
- 0 ν (neutrino)

T: $\pm\frac{1}{2}$

Y:
- $\pm\frac{1}{6}$ quark
- $\pm\frac{1}{2}$ lepton

Now let's consider what quarks and leptons are.
In the Standard Model, charge is the sum of isospin and hypercharge.
Isospin is $\pm 1/2$.
Leptons have a hypercharge of $\pm 1/2$, so their charge is an integer.
Quarks have a hypercharge of $\pm 1/6$, so their charge is a non-integer.

Fermion charge and color

	Charge Q =	Isospin T $\pm 1/2$	Hypercharge + Y_R $\pm 1/6$	+ Y_G $\pm 1/6$	+ Y_B $\pm 1/6$	Color
ν_e	+0	+1/2	−1/6	−1/6	−1/6	
$\bar{d}$	+1/3	+1/2	−1/6	−1/6	+1/6	R
	+1/3	+1/2	−1/6	+1/6	−1/6	G
	+1/3	+1/2	+1/6	−1/6	−1/6	B
u	+2/3	+1/2	+1/6	+1/6	−1/6	R
	+2/3	+1/2	+1/6	−1/6	+1/6	G
	+2/3	+1/2	−1/6	+1/6	+1/6	B
$\bar{e}$	+1	+1/2	+1/6	+1/6	+1/6	

In addition to their electric charge, quarks have three colors.
So, let's split up hypercharge into three colors.
All types of electric charge can be expressed by combining the signs.
Only quarks have a bias in hypercharge, which corresponds to a color.
The table only shows particles with positive isospin, but there are also negative ones.
When all the signs are reversed, they become antiparticles.

Fermion model

Isospin	Hypercharge
T	$Y_R + Y_G + Y_B$

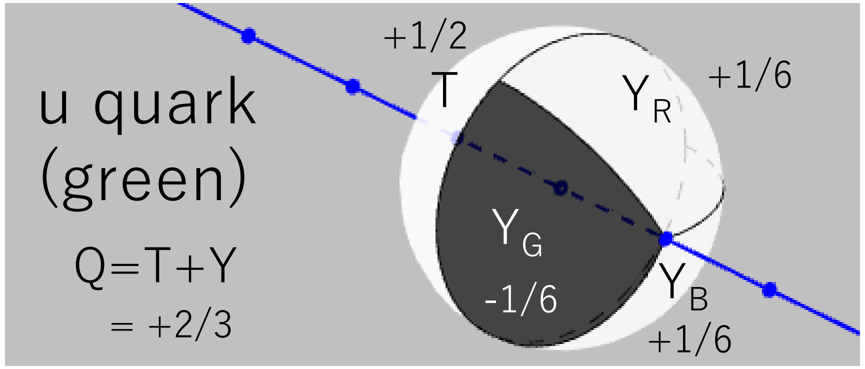
$$\underset{\pm 1/2}{T} + \underset{\pm 1/6}{Y_R} + \underset{\pm 1/6}{Y_G} + \underset{\pm 1/6}{Y_B}$$

Time (1D) component

1 : 1

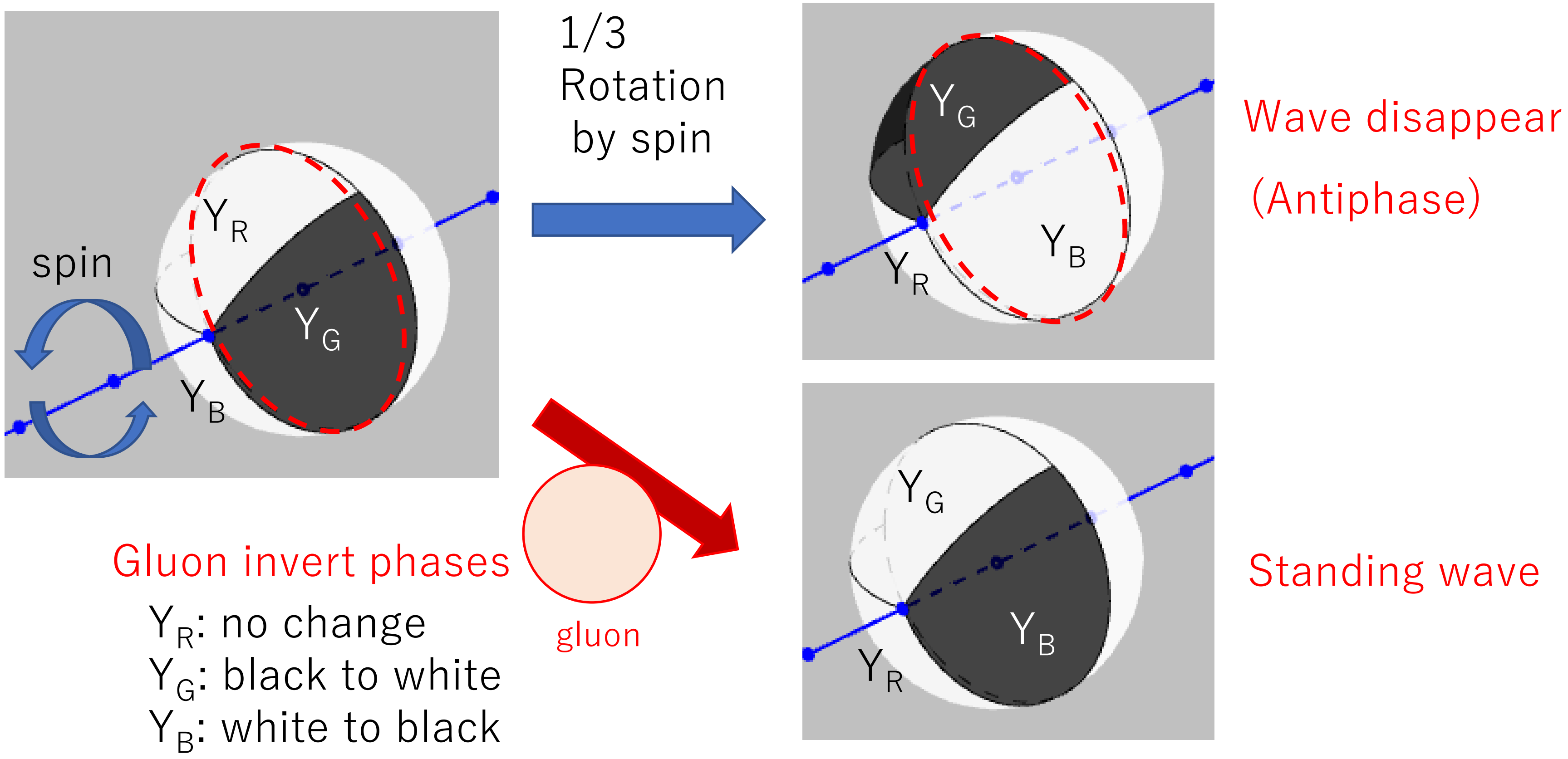
Space (3D) component

(3 degrees of freedom)



Let's think about why fermion charge has these degrees of freedom.
We assume that isospin represents temporal properties, and hypercharge represents spatial properties.
Time and space have a one-to-one relationship, and in a schematic diagram, they are each hemispheres.
As space is three-dimensional, it can be divided into three degrees of freedom.
The colors correspond to the three orthogonal axes of space.
The only difference between types of fermions is the orientation of the fourth-dimensional space-time.

Strong force



Next, let's consider the strong force.
The presence of color means that the phase of the hypercharge parts is not consistent.
When it interferes with itself before it spins, the wave partially disappears.
The strong force is mediated by gluons.
Gluons are thought to swap the phase of the hypercharge parts.
As a result, phases that are in the same direction do not change before and after rotation.
This can be described as a standing wave.

Coupling constant of strong force

	R	G	B
0°	+	−	−
120°	−	+	−
240°	−	−	+
360°	+	−	−

1/3 color always same phase

Hyper charge side 2/3 color

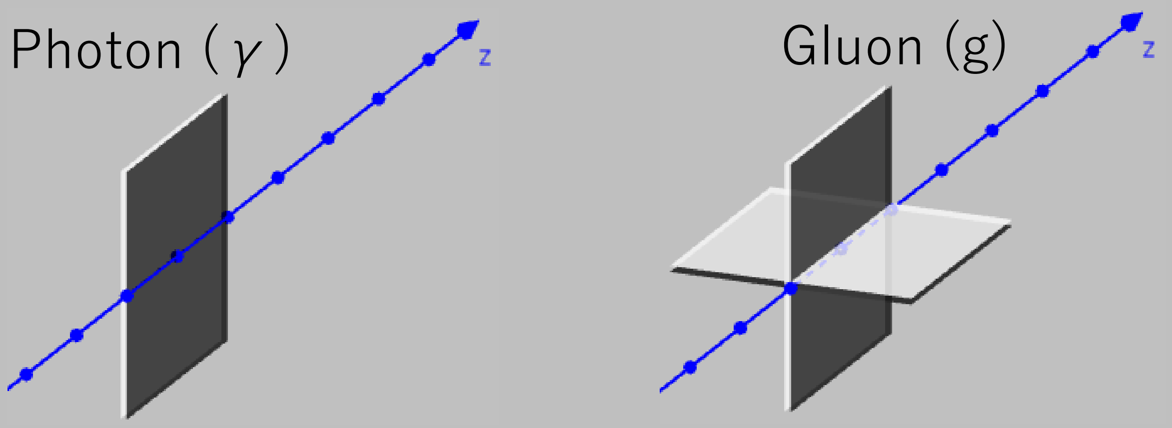
(Theoretical value) $\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$

$$\left(\frac{1}{3}\right)^2 = \frac{1}{9} = 0.111$$

(Actual measurements) $\alpha_S = 0.118\ [M_Z]$

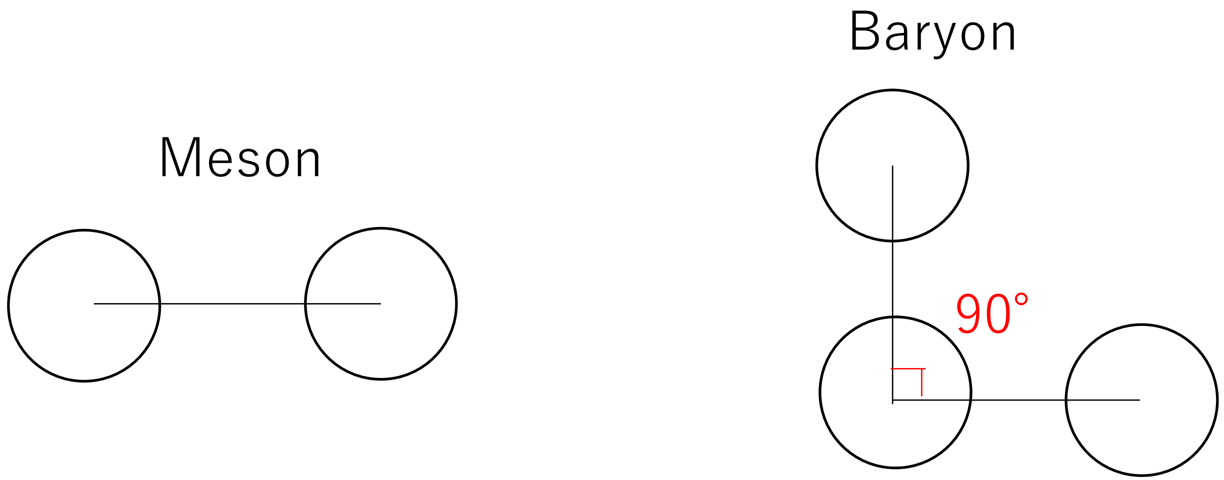
Calculate the gauge coupling constant of the strong force.
Since only the hypercharge side may interfere with rotation, the strength of the force is 1/2.
Also, as shown in the table, only one color will always be in phase even if it is rotated.
Only 2/3 of the hypercharge side will interfere and cancel out the waves.
Multiplying 1/2 and 2/3 gives us the gauge coupling constant 1/3.
When squared to fit the standard theory, the value is close to the actual measurement.
Although the gluon has a spin of 1, there is no attenuation of the force due to the tilt of the axis.
This is because the wave annihilation cannot be prevented unless there is complete mediation.
Multiple gluons act to mediate completely.

Schema of gluon



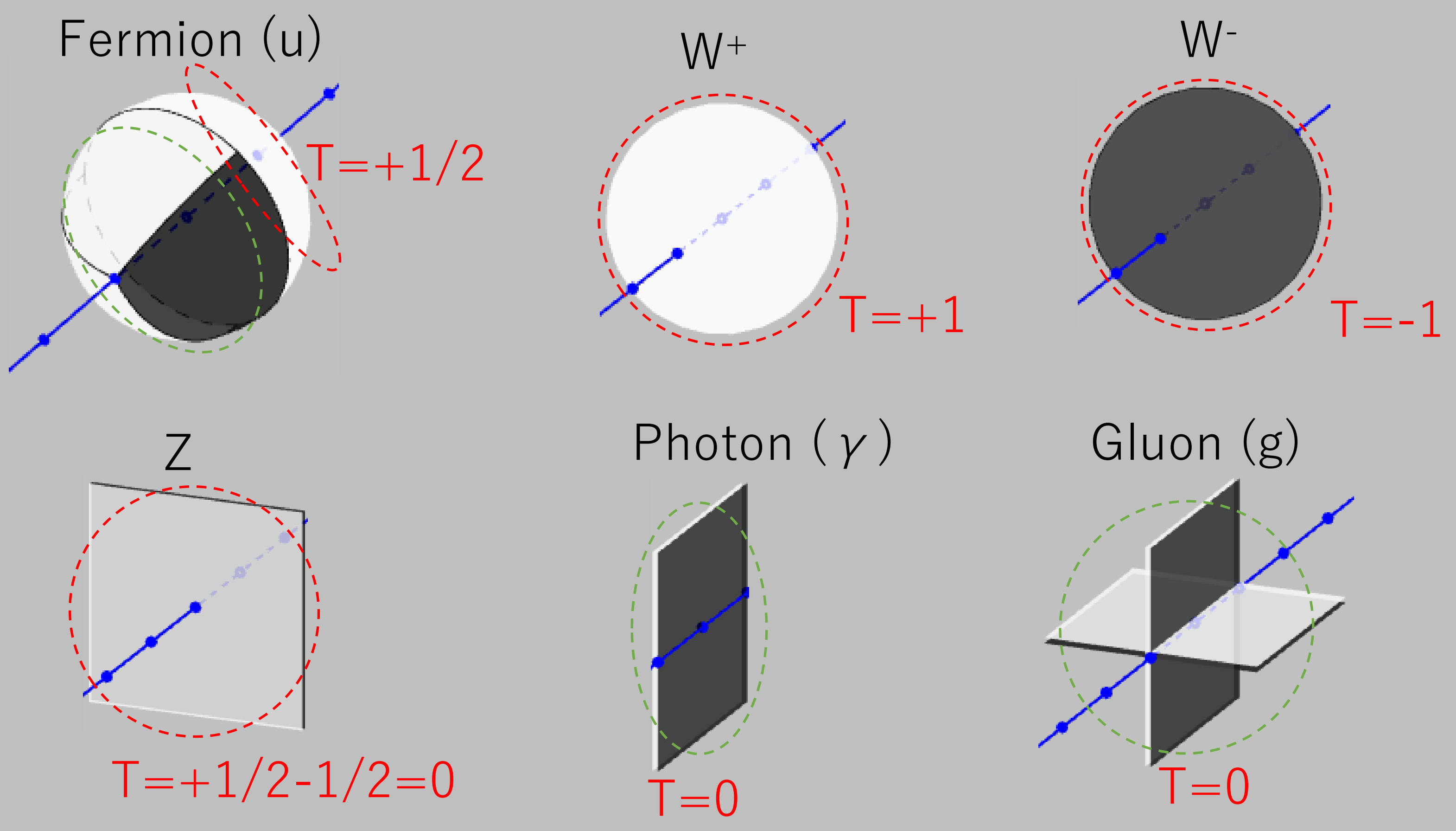
Let's consider gluons.
As one color remains in phase even when rotated, the gluon needs to invert the phase of the remaining two color.
The three color correspond to the three axes of space.
In a schematic diagram, gluons become two orthogonal planes.
Like photons, they are symmetric with respect to the direction of travel and so have no mass.
The direction they are facing determines which two color are inverted.
In the Standard Model, there are eight gluons, but one is enough.

Schema of hadron



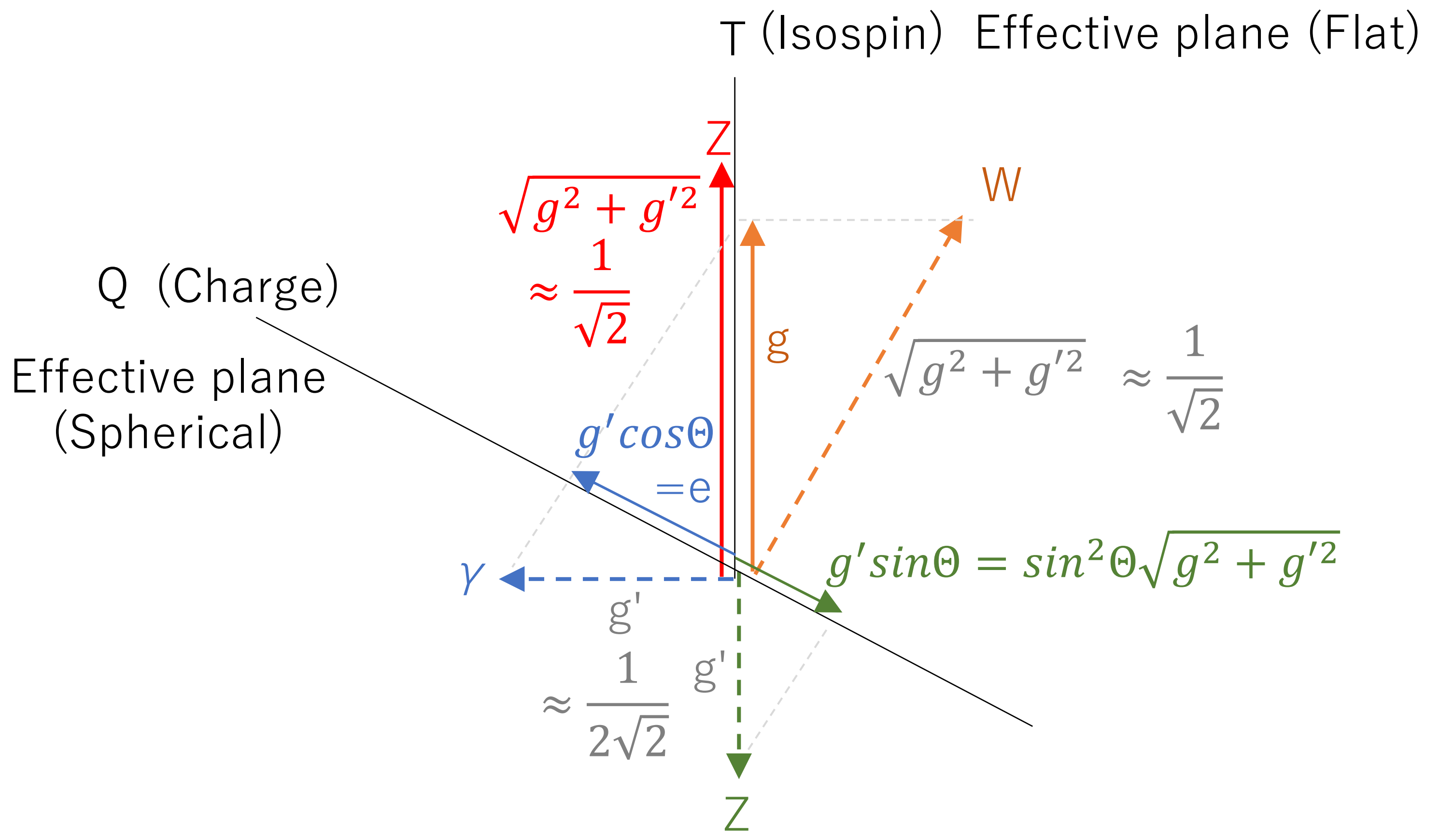
Let's think about hadrons in a schematic diagram.
A meson is made up of two quarks.
A baryon is made up of three quarks.
The three quarks must be arranged at 90 degrees.
The color represent three orthogonal spatial axes.
If they are not 90 degrees apart, the color will change and will not combine to become colorless.

Weak isospin



Next, we consider the weak force.
The weak force only acts on particles that have isospin.
The hemisphere of a fermion is isospin, and its value is ±1/2.
The W boson has isospin of ±1.
A sphere made up of two isospin hemispheres joined together corresponds to the W boson.
The Z boson is thought to have +1/2 and -1/2, which sums to 0.
Photons and gluons do not interact weakly.
They are thought to be particles with properties similar to the hypercharge side of fermions.

Electromagnetic unify



This is an illustration of the strength of forces in the electroweak unified theory.
The dotted arrows represent the asymmetry that gauge particles inherently possess.
The solid line represents the effective magnitude of the force.
Warm colors represent the force acting on isospin, and cool colors represent the force acting on charge.
Since only half of the charge interacts at a distance, the asymmetry is 1/2.
Charges act on a sphere.
Since isospin is tilted about 30 degrees from the axis of the charge, it can be inferred that it is a force acting in a plane.
Since the Z boson is flat, the weak force has 100% effect.
Since the W boson is spherical, the weak force only acts for the cosine of 30 degrees.

Weak force asymmetry

	Higgs interaction	Weak interaction
$W^{\pm}/Z$ ratio	Mass	Gauge coupling constant
	cos30°	cos30°
Asymmetry	Parallel move in space	Parallel move in time

Let's think about what asymmetry the weak force mediates.
The ratio of W to Z bosons is cosine 30 degrees for both the weak force and mass.
The asymmetry of the weak force matches the asymmetry of mass.
The asymmetry when moving parallel through space is mass.
On the other hand, the weak force only acts on isospin, which has a time-related property.
We infer that the asymmetry when moving through time rather than space is the weak force.

Weak coupling constant

Z gauge coupling constant

Spin1

$$\cos 45° = \frac{1}{\sqrt{2}} = 0.707 \quad \text{(Theoretical)}$$

$$\sqrt{g^2 + g'^2} = \frac{g}{\cos\Theta_W} = 0.718 \quad \text{(Measured)}$$

W$^{\pm}$ gauge coupling constant

Spin1 Sphere horizontal

$$\cos 45° \times \cos 30° = \sqrt{\frac{3}{8}} = 0.612 \quad \text{(Theoretical)}$$

$$g = e\sin\Theta_W = 0.630 \quad \text{(Measured)}$$

Calculate the gauge coupling constant of the weak force.
The damping due to spin 1 is the same as in the case of mass.
As with mass, it does not become 1/2 like the electromagnetic force.
The force of the W boson is weaker than the Z boson by the angle between the plane and the sphere.
The gauge coupling constant is close to the measured value.

Weak interactable particle

Particle
(all left-handed)

	T	Y_R	Y_G	Y_B	$Y_R \times Y_G \times Y_B$
ν_L	+	−	−	−	−
d_L	−	+	+	−	−
u_L	+	+	+	−	−
e_L	−	−	−	−	−

Antiparticle
(all right-handed)

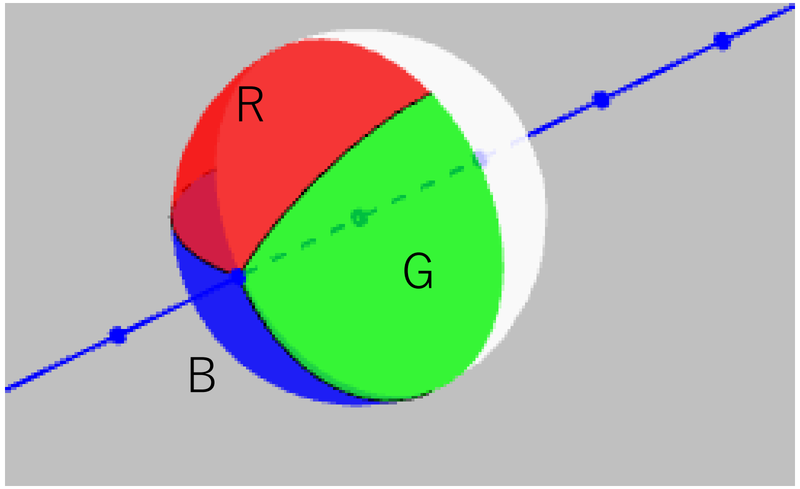
	T	Y_R	Y_G	Y_B	$Y_R \times Y_G \times Y_B$
$\bar{\nu}_R$	−	+	+	+	+
$\bar{d}_R$	+	−	−	+	+
$\bar{u}_R$	−	−	−	+	+
$\bar{e}_R$	+	+	+	+	+

The product of the signs of the hypercharge(Y)
= right-handed or left-handed
(Number of mirror image inversions)

Let's consider why the weak force only works on left-handed particles and right-handed antiparticles.
The table shows only those that the weak force acts on.
By multiplying the three signs of hypercharge, we were able to distinguish whether right-handed or left-handed is effective.
Each time the sign of one of the three color is reversed, the left and right are reversed.
Reversing the sign of one color can be thought of as reflecting it in a mirror once.
If it is reflected in a mirror twice, the mirror image will return to its original state.

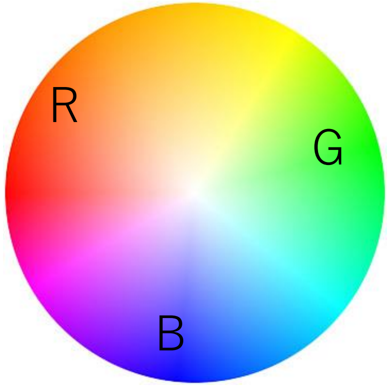
Schema of hypercharge

Fermion



Simple schema

Fermion
(hypercharge side)



More accurate schema

In the left image, the three hypercharge fermions are shown on a 1/6 sphere.
This is not exact.
In the right image, the three colors correspond to the components of three orthogonal axes in space.
Reversing the sign of each color means reversing that axis.

Weak interactable chirality

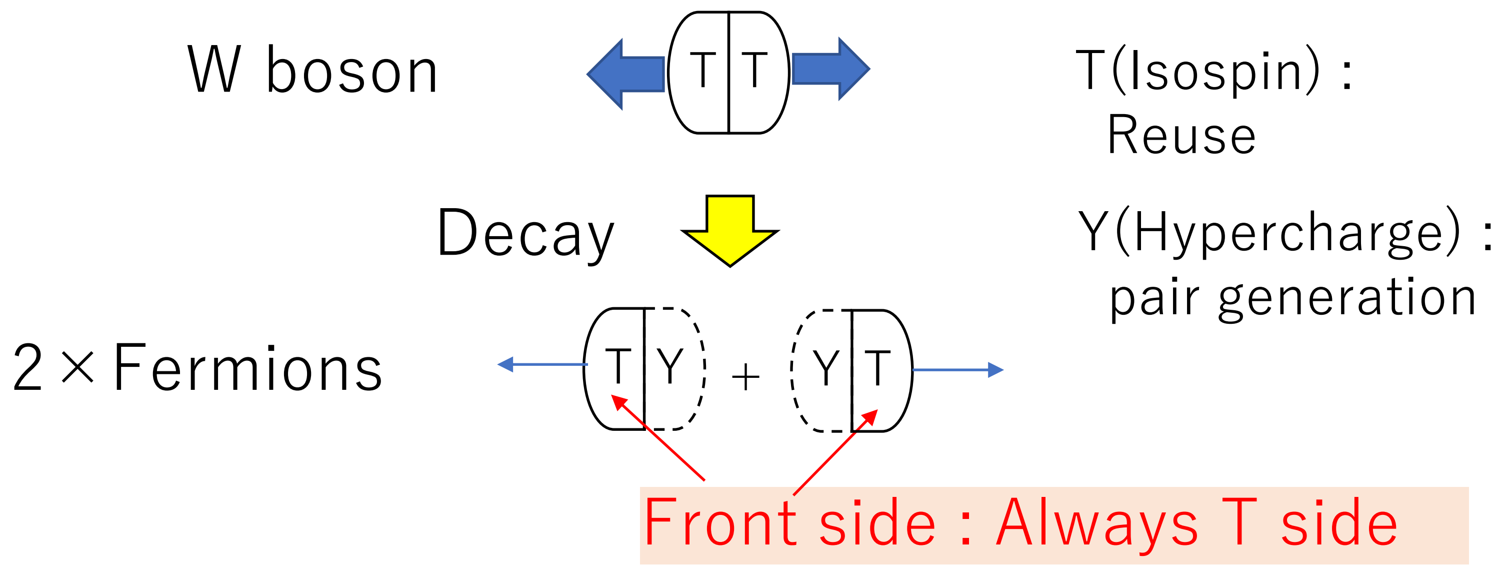
	T	Y_R	Y_G	Y_B	$Y_R \times Y_G \times Y_B$	Chirarity	Chirarity $\times Y_R \times Y_G \times Y_B$
ν_L	+	−	−	−	−	−	+
d_L	−	+	+	−	−	−	+
u_L	+	+	+	−	−	−	+
e_L	−	−	−	−	−	−	+

	T	Y_R	Y_G	Y_B	$Y_R \times Y_G \times Y_B$	Chirarity	Chirarity $\times Y_R \times Y_G \times Y_B$
$\bar{\nu}_R$	−	+	+	+	+	+	+
$\bar{d}_R$	+	−	−	+	+	+	+
$\bar{u}_R$	−	−	−	+	+	+	+
$\bar{e}_R$	+	+	+	+	+	+	+

Chirality of weak interactable particles before mirror invert was match

Before it is reversed by hypercharge, we need to consider whether it is right-handed or left-handed.
If we consider right-handedness to be positive, and multiply it by hypercharge, everything becomes positive.
On the other hand, even if isospin is reversed, left and right do not get reversed.
Since isospin is the direction of time, the direction of travel is also reversed, so we think that it does not become a mirror image.

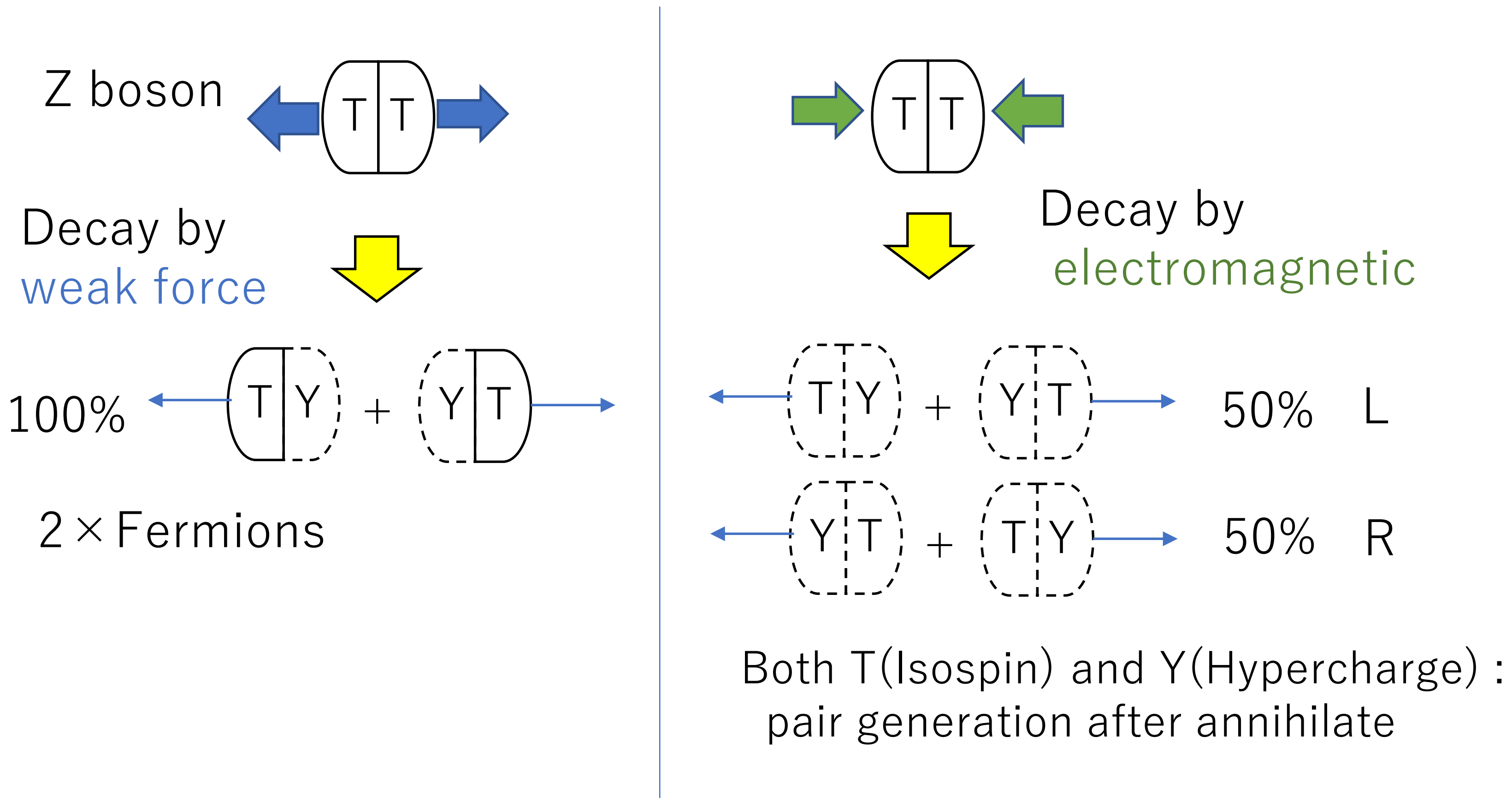
W boson decay



Chirality : Front side is T or Y

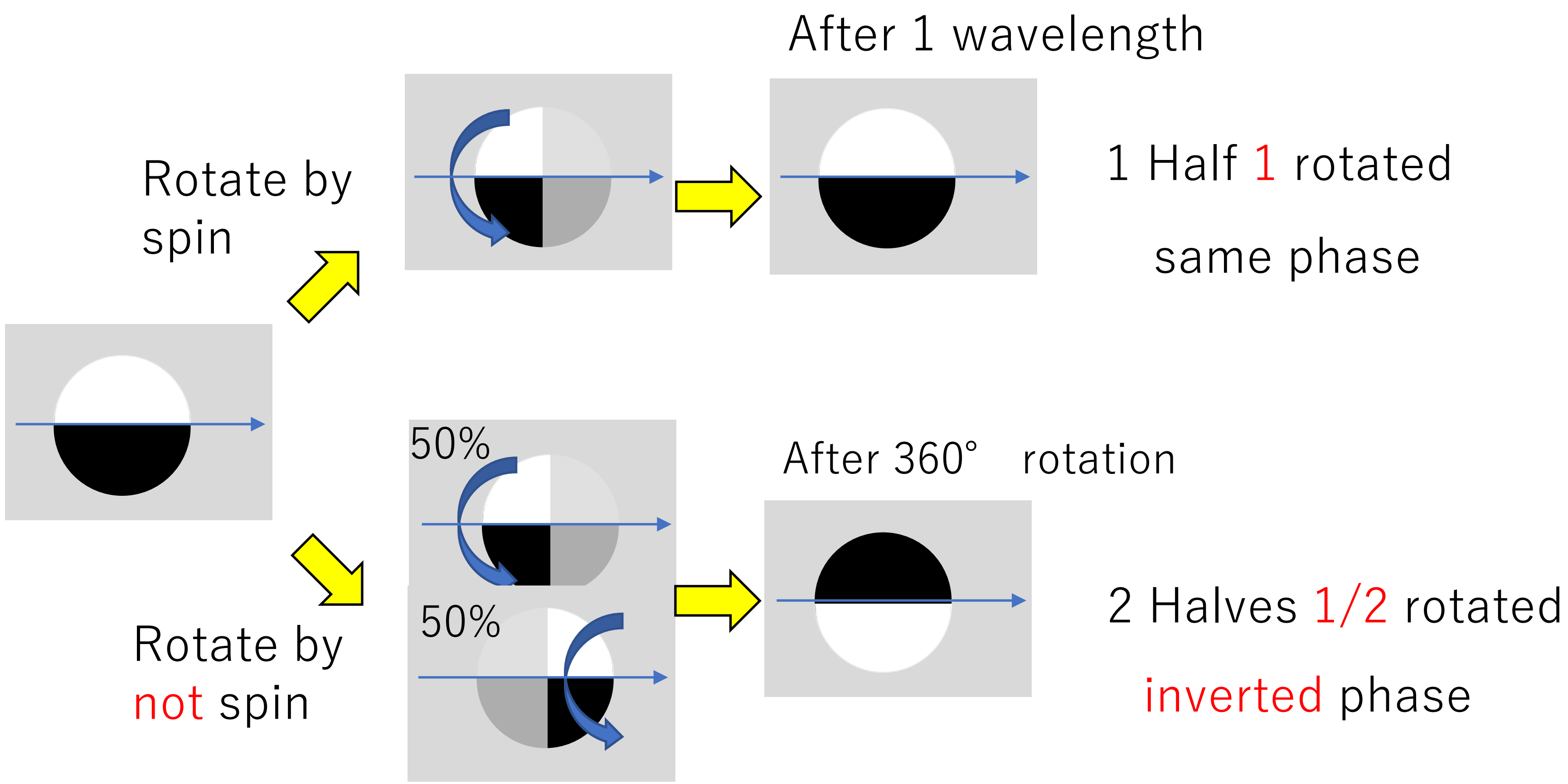
Let's consider why the weak force only acts on one side by using the example of a weak boson decaying into a fermion.
Fermions are made up of isospin and hypercharge, while weak bosons are made up of two isospins.
We think of a weak boson as breaking off and only the hypercharge part being paired.
The isospin part is reused.
Therefore, the isospin side will always be in front in the direction of travel.
We deduce that chirality determines whether the isospin side or the hypercharge side is in front in the direction of travel.
When explaining mass, it was predicted that the Higgs swaps the front and back of particles.
On the other hand, in the Standard Model, the Higgs swaps chirality.
If swapping front and back results in a mirror image, these interpretations are not contradictory.

Z boson decay



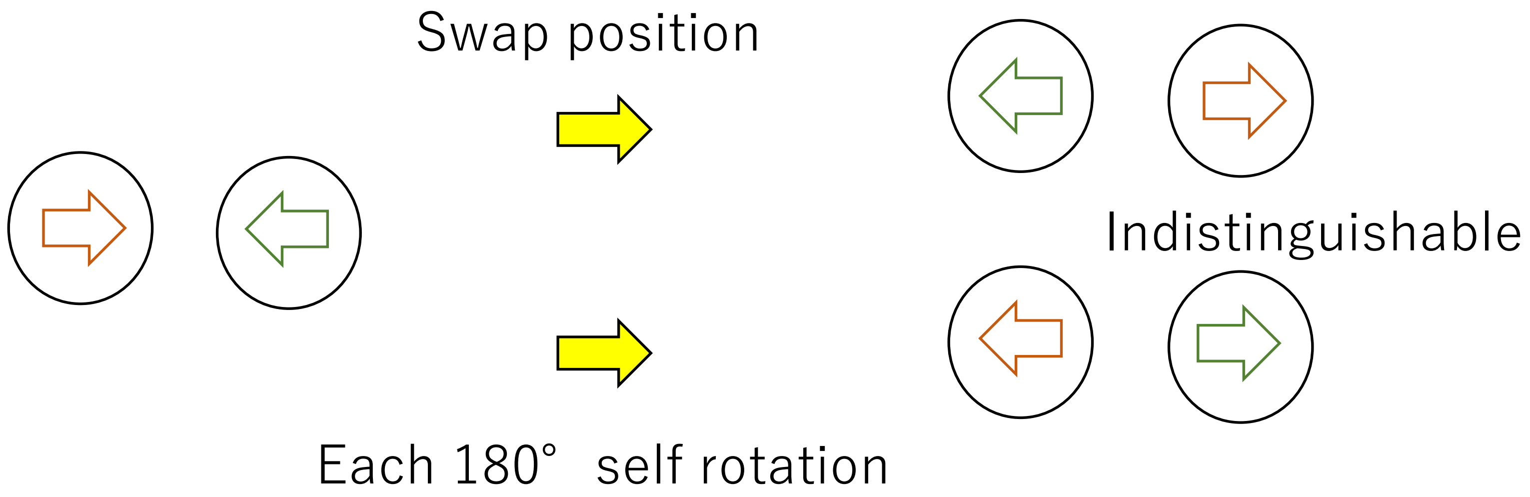
The Z boson not only decays due to the weak force, but also due to electromagnetic force, like the photon.
When it decays due to the weak force, only one-handed particles are produced.
On the other hand, it is known that when it decays due to the electromagnetic force, both hands are produced.
When it decays due to the electromagnetic force, it is thought that it completely annihilates and then pairs are created without being reused.
In that case, it is not necessary for the front side to be the isospin side, and it becomes random.
With the electromagnetic force, we can imagine a force that contracts to a single point at the center in order to annihilate.
On the other hand, with the weak force, we can imagine a force that moves outward, as if torn apart.
Because the two forces are in opposite directions, they weaken each other.
For that reason, even in the Standard Model, the Z boson interacts more strongly with neutrinos than charged leptons.

Phase of 1/2spin



Let's also consider phenomena other than force and mass.
A spin 1/2 fermion will have its phase inverted when rotated 360 degrees, and will return to its original phase when rotated 720 degrees.
It will also return to its original phase by moving one wavelength, but its angular momentum is only half.
This can be explained without contradiction if we think about it as follows.
If the particle rotates once in half, alternately, over one wavelength, it will return to its original state with half the angular momentum.
When rotated by a method other than spin, we can think of both particles as rotating by half a degree.
Therefore, even if you think you have rotated it 360 degrees, it actually does not rotate half a degree, and it is thought that the phase will invert.

Pauli Exclusion Principle

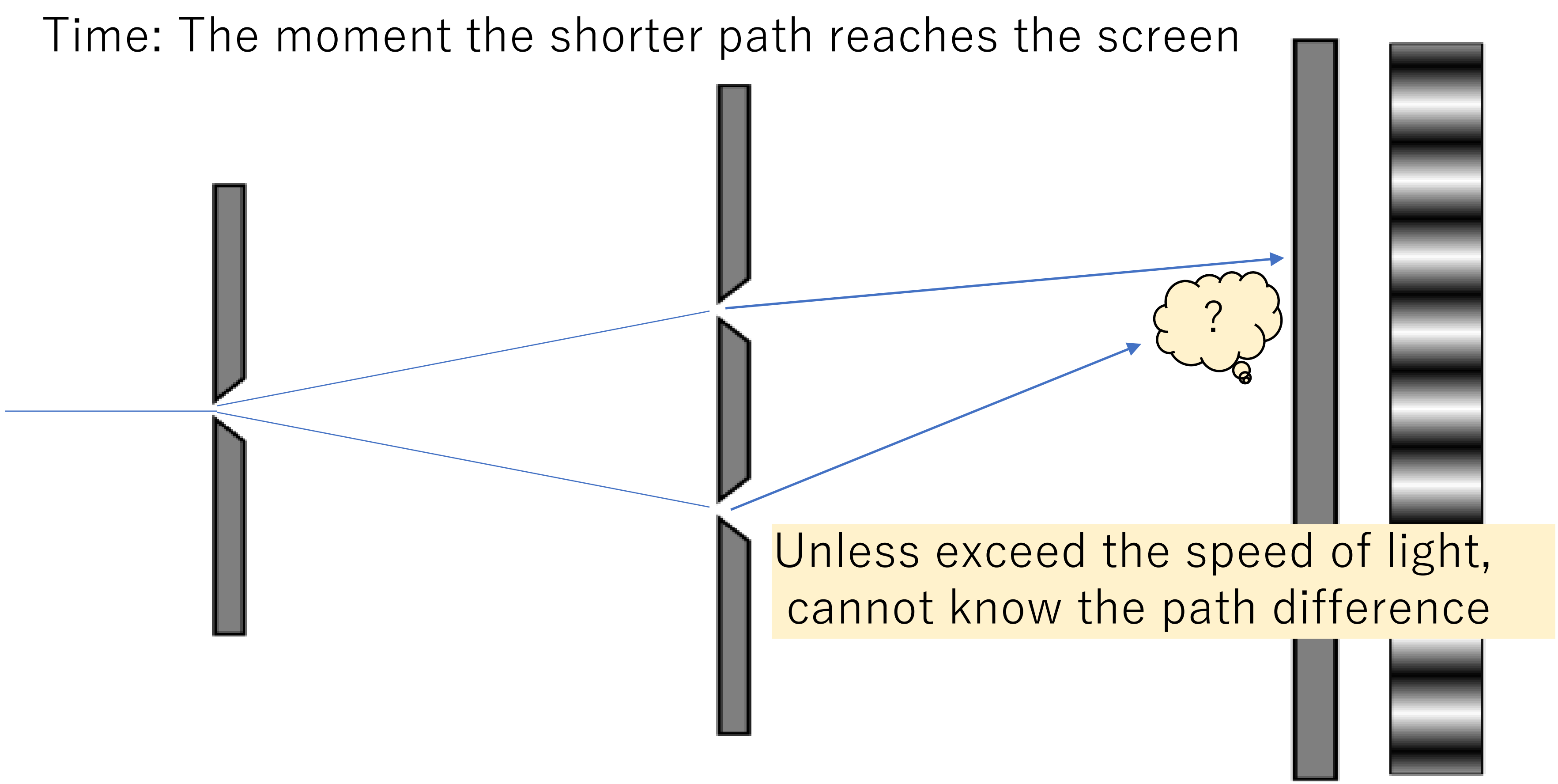


Total 360°

＝ Interference in opposite phase

Let's also consider the Pauli exclusion principle.
If two fermions swap their positions, the sign of the wave function will be reversed.
Diagrammatically, by swapping positions, particles that were looking at each other will now be back-to-back.
This is the same as two particles each rotating 180 degrees.
If there are two indistinguishable particles at the same coordinates, it is indistinguishable from such a rotation.
In total, they will have rotated 360 degrees, and the phase will be inverted.
This cannot be distinguished from a phase-inverted state, and the waves will cancel each other out, so it cannot exist.

Faster-than-light interference



Let's consider how to interpret the results of the double slit experiment.
Consider the moment when the photon that has taken the shorter path arrives at a certain position on the screen, as shown in the diagram.
At this point, the photon that has taken the longer path has not yet reached the screen, unless it exceeds the speed of light.
Without a faster-than-light wave like a pilot wave, it is unclear how they would interfere.
In quantum mechanics, the arrival time is ignored, and all waves arriving at the same position are superimposed.
Since reality can be predicted with just the total superimposed data, the time information can be discarded.
The sum of the amplitudes at a certain coordinate is constant regardless of time.
This can be expressed as a standing wave.
As it is independent of time, it can be expressed as three-dimensional information rather than four-dimensional information.

Principle of standing wave

Principle

All particles are standing waves

Forces act to maintain the waves

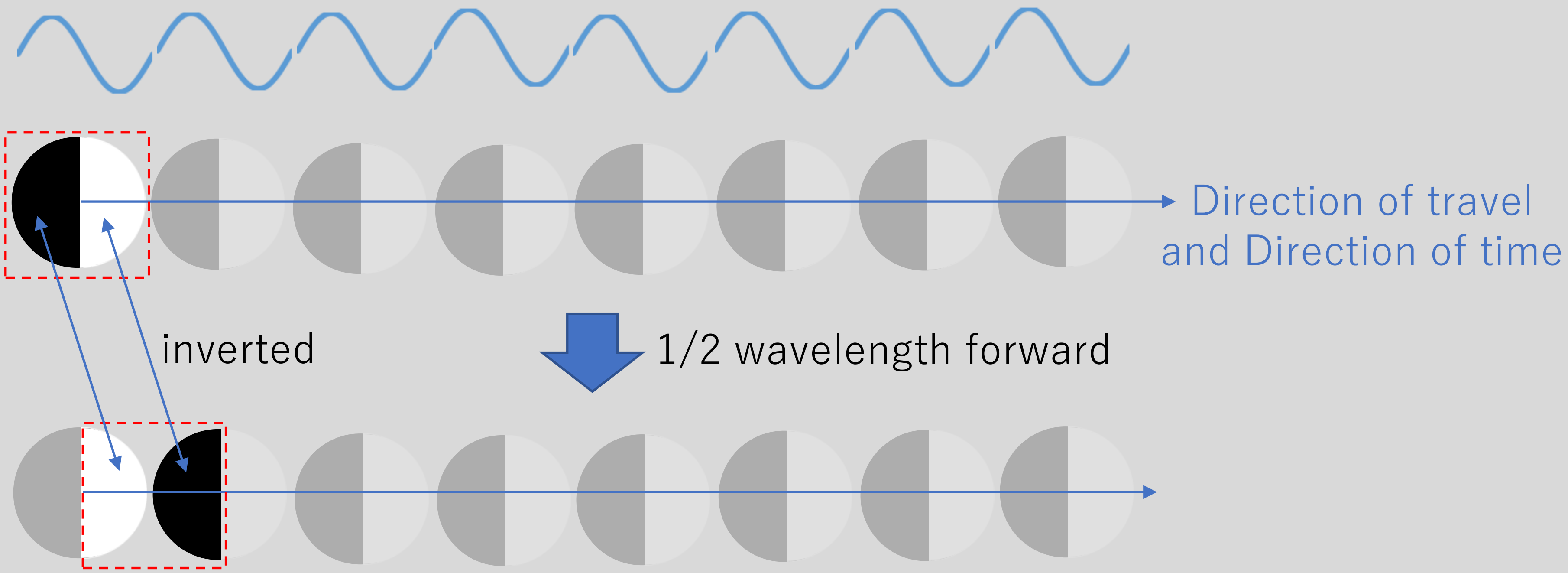
Particle information is described as a 3D map of vectors

Map coodinate system		Information on the map
x	Perpendicular to the direction of travel	3D Vector (Phase direction)
y	Perpendicular to the direction of travel	
z	Direction of travel and Direction of time	

Time and space axes cannot be distinguished

From the discussion so far, it can be said that in principle all particles are standing waves.
Every force and mass acts to maintain the wave.
A particle in a certain state is represented by certain three-dimensional information.
Since phase is nothing more than a spatial direction, it is a three-dimensional map of vectors.
In this three-dimensional information, the spatial axis of travel and the time axis are shared and cannot be distinguished.

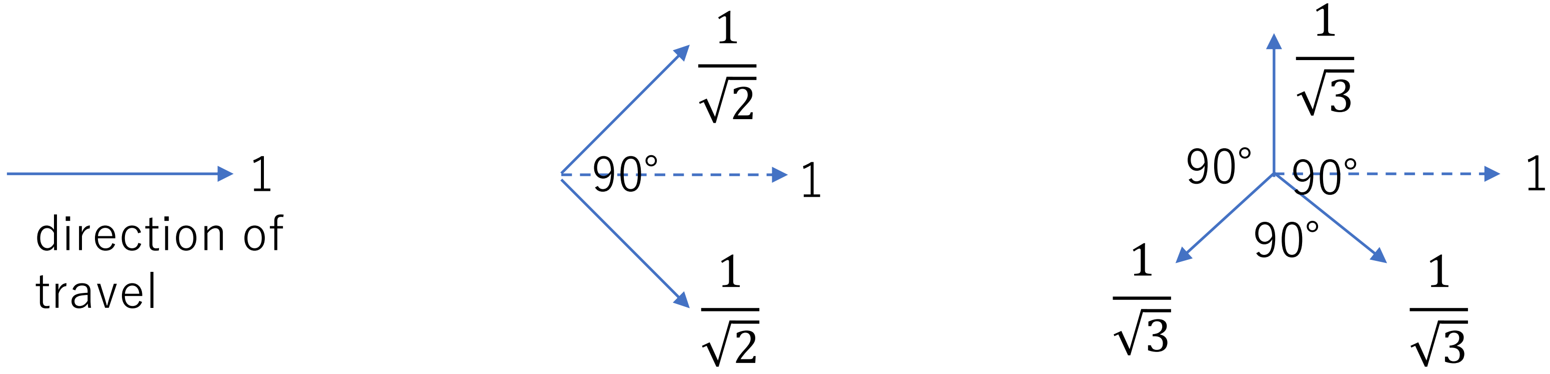
Schema of standing wave



If we illustrate a standing wave in a schematic diagram, it consists of particles arranged at a period that is the wavelength.
There is something like a moving window, and at any given time only a part of the standing wave is visible.
It is not possible to distinguish whether the part closer to the front is forward in space or time.
In principle, its time and position are uncertain, and it is a point that is also spread out in space.
After traveling half a wavelength, the phase appears to be inverted.

Generation of travel

Generation: 1 | Generation: 2 | Generation: 3



Mass limit

$1M_H$ (Higgs mass) =125.2 GeV/c^2

$2 \times \frac{1}{\sqrt{2}} M_H = \sqrt{2} M_H$ =177.1 GeV/c^2

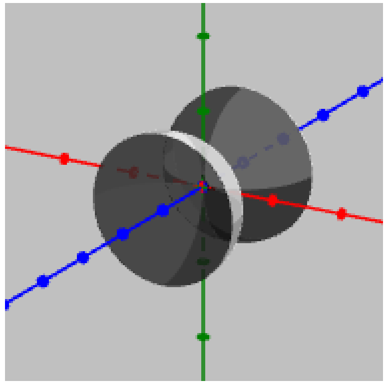
$3 \times \frac{1}{\sqrt{3}} M_H = \sqrt{3} M_H$ =216.9 GeV/c^2

Top quark mass: 172.6 GeV/c^2 (measured)

Next, let's consider the generation and mass of fermions.
We predicted that the Higgs particle would be the most asymmetric and the heaviest.
However, the top quark is heavier than the Higgs particle.
We therefore consider it to travel in a straight line as a result of traveling in two or three directions simultaneously.
Multiple Higgs particles cause phase swaps in multiple directions.
In this case, up to the root of three times the Higgs particle is possible, so this is within the range.
We can predict that the number of dimensions that collide with the Higgs particle is the generation of the fermion.

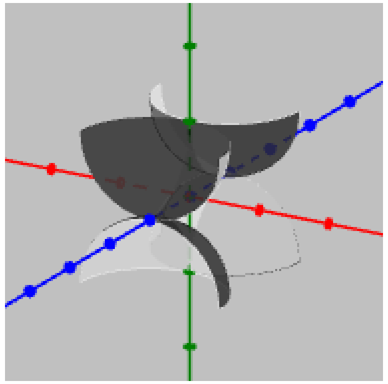
Generation of mixture

Generation: 1



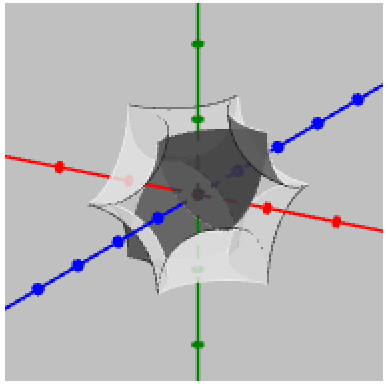
Segments: 2

Generation: 2



Segments: 4

Generation: 3



Segments: 8

Generation of fermion = Mixture dimension of T(isospin) and Y(hypercharge)

Only fermions have T, Y part, and generation

When exchanged in multiple directions by the Higgs, fermions are divided into 2, 4, or 8 segments.
In each segment, the isospin and hypercharge parts are arranged symmetrically.
The more dimensions the division is made into, the more evenly the two parts are mixed.
The generation can be thought of as the dimensionality of the mixing of isospin and hypercharge.
Generations only exist for fermions, because fermions are the only particles that have both isospin and hypercharge parts.

Mass trends

Gen.	1	2	3
Mass	d	< s	< b
	u	< c	< t
	e	< μ	< τ
			W, Z, H

Q	0	±1/3	±2/3	±1
Mass	ν_e	<< d	> u	> e
	ν_μ	<< s	< c	> μ
	ν_τ	<< b	< t	> τ
	Z, H			> W

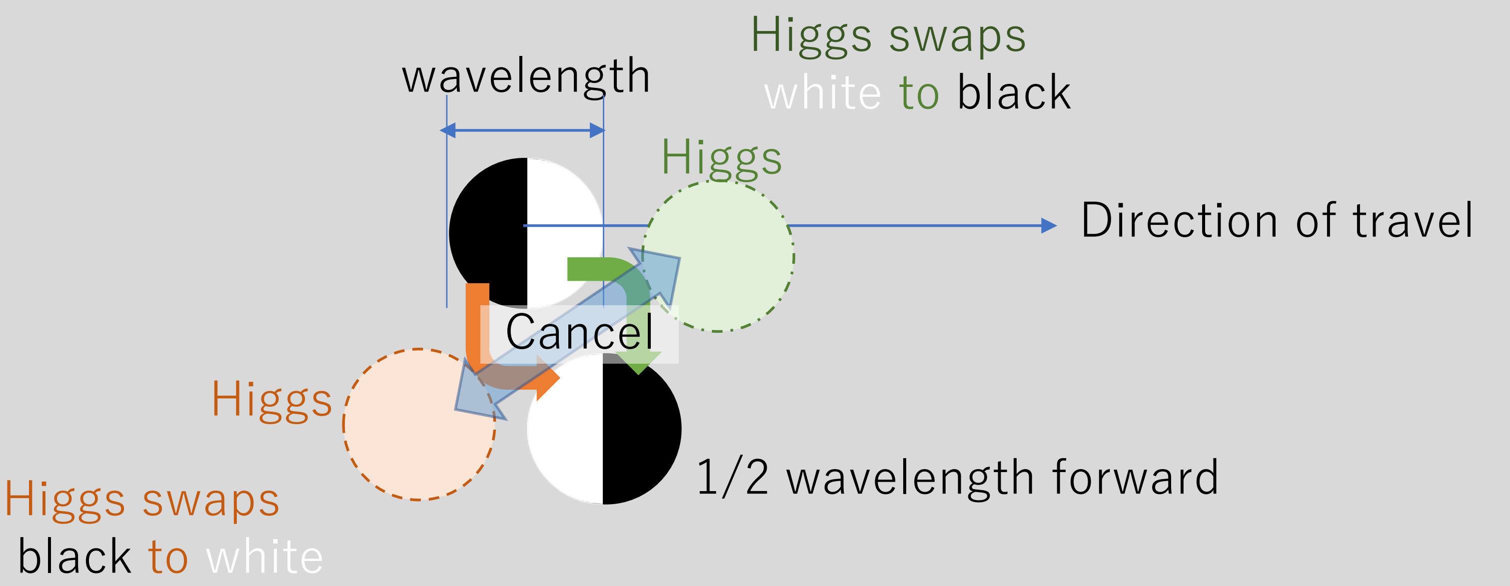
Lower generation: Number of dimensions colliding with the Higgs decreases

Neutrino: Symmetric and massless, but may have mass through secondary effect

Charged lepton: Antisymmetric, Higgs may be cancelled out, and lighter

The mass trends are shown in a table.
We think that the mass of the third generation is the original mass.
Therefore, the mass of bosons is equivalent to the third generation.
In lower generations, it is thought that the number of dimensions that collide with the Higgs decreases.
Neutrinos are symmetric and have no mass, but they may have mass due to a secondary effect.
Charged leptons are antisymmetric, so the Higgs may cancel out, making them lighter.
Quarks are neither symmetric nor antisymmetric, so they cannot become lighter.

Higgs cancellation



The cancellation of Higgs is illustrated here.
The two Higgs exchange phases for the front and back parts respectively.
If the front and back are completely antisymmetric, the two Higgs do opposite work.
If the two Higgs cancel each other out, the mass disappears.

Koide formula

Koide formula

$$\frac{M_e + M_\mu + M_\tau}{\left(\sqrt{M_e} + \sqrt{M_\mu} + \sqrt{M_\tau}\right)^2} = \frac{2}{3}$$

(Center)

$$\frac{1+1+1}{\left(\sqrt{1} + \sqrt{1} + \sqrt{1}\right)^2} = \frac{1}{3}$$

(Min)

$$\frac{0+0+1}{\left(\sqrt{0} + \sqrt{0} + \sqrt{1}\right)^2} = 1$$

(Max)

Here is an empirical formula for the masses of charged leptons.
With high precision, the value of this formula is 2/3.
If the three leptons have the same mass, the value will be 1/3 of the minimum value.
If one of the leptons is extremely heavy, the value will be the maximum value of 1.
The actual mass is exactly halfway between the maximum and minimum values.
The ratio of the three values is neither 1 nor extremely large, but is a well-balanced, natural ratio.
Once you know two masses, you can calculate the remaining one using this formula.

Geometric lepton mass

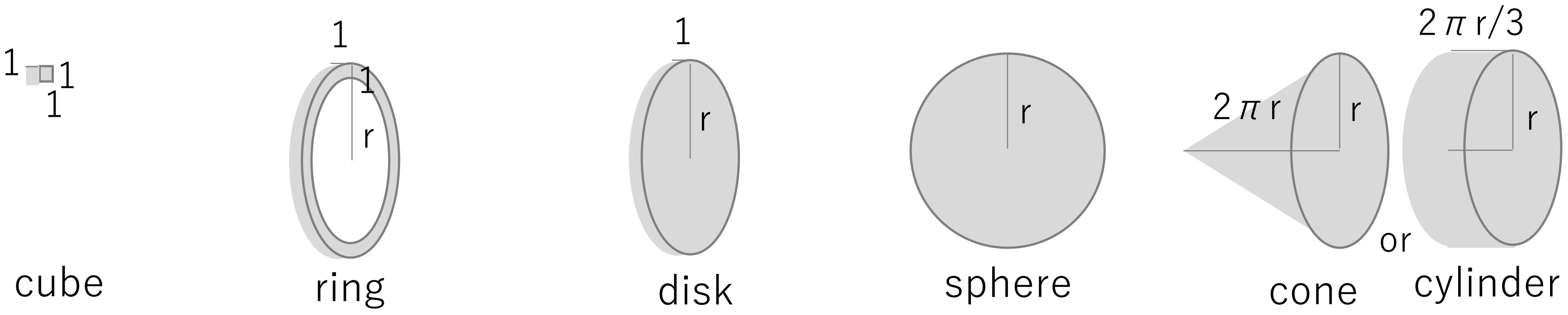
$$\frac{M_e + M_\mu + M_\tau}{\left(\sqrt{M_e} + \sqrt{M_\mu} + \sqrt{M_\tau}\right)^2} = \frac{2}{3} \qquad M_e = 1 \times M_e \qquad M_\mu = 2\pi r \times M_e \qquad M_\tau = \pi r^2 \times M_e$$

$$r = 33.577$$

		(Actual measurement)
M_e		$0.511\text{MeV}/c^2$
$M_\mu = 2\pi r \times M_e$	$= 107.8\text{MeV}/c^2$	$105.7\text{MeV}/c^2$
$M_\tau = \pi r^2 \times M_e$	$= 1810\text{MeV}/c^2$	$1777\text{MeV}/c^2$
$M_W = \frac{4}{3}\pi r^3 \times M_e$	$= 81.0\text{GeV}/c^2$	$80.4\text{GeV}/c^2$

With another equation, we can calculate the masses of the other two based on the mass of the electron.
We think that the generation is the number of dimensions that collide with the Higgs.
We therefore assume that the mass ratio of the three leptons has a relationship between a point, a circumference, and a circle's area.
By solving the simultaneous equations in combination with the Koide formula, we were able to find the radius.
A predicted value that was close to the actual measured value was obtained.
Furthermore, when the mass was calculated for a sphere, it was close to that of the W boson.

Higgs collision volume



cube	ring	disk	sphere	cone or cylinder
$V_e = 1$	$V_\mu = 2\pi r$	$V_\tau = \pi r^2$	$V_W = \frac{4}{3}\pi r^3$	$V_H = \pi r^2 \times \frac{2\pi r}{3}$
$M_e = \frac{V_e}{V_H} M_H$	$M_\mu = \frac{V_\mu}{V_H} M_H$	$M_\tau = \frac{V_\tau}{V_H} M_H$	$M_W = \frac{V_W}{V_H} M_H$	$M_H =$
$= 0.503 MeV/c^2$	$= 106.0 MeV/c^2$	$= 1780\ MeV/c^2$	$= 79.7 GeV/c^2$	
$0.511 MeV/c^2$	$105.7\ MeV/c^2$	$1777 MeV/c^2$	$80.4 GeV/c^2$	$125.2 GeV/c^2$

(Actual measurement)

Although the units for a point, length, and area are different, when multiplied by the unit length, they become the same physical quantity.
This can be interpreted as representing the volume that collides with the Higgs.
We also considered the shape of the Higgs particle itself.
We assume that it is a cone whose length is the circumference, or a cylinder whose length is one-third of the circumference.
Then, the mass of an electron could be calculated in terms of its volume ratio to the Higgs.
In particular, a point, circumference, circular area, and cylinder are all parts of a cylinder.
This represents the fact that the number of dimensions that collide with the Higgs decreases as the generation becomes smaller.

Geometric neutrino mass

$$V_H = \pi r^2 \times \frac{2\pi r}{3} \qquad r = 33.577$$

$$M_1 = \frac{r^{-2}}{V_H^2} M_H \qquad = 0.00179 eV/c^2$$

$$\Delta M_{21}^2 \quad = 7.37 \times 10^{-5} (eV/c^2)^2 \qquad 7.53 \times 10^{-5} (eV/c^2)^2$$

$$M_2 = \frac{r^{-1.5}}{V_H^2} M_H \qquad = 0.0104 eV/c^2$$

(Actual measurement)

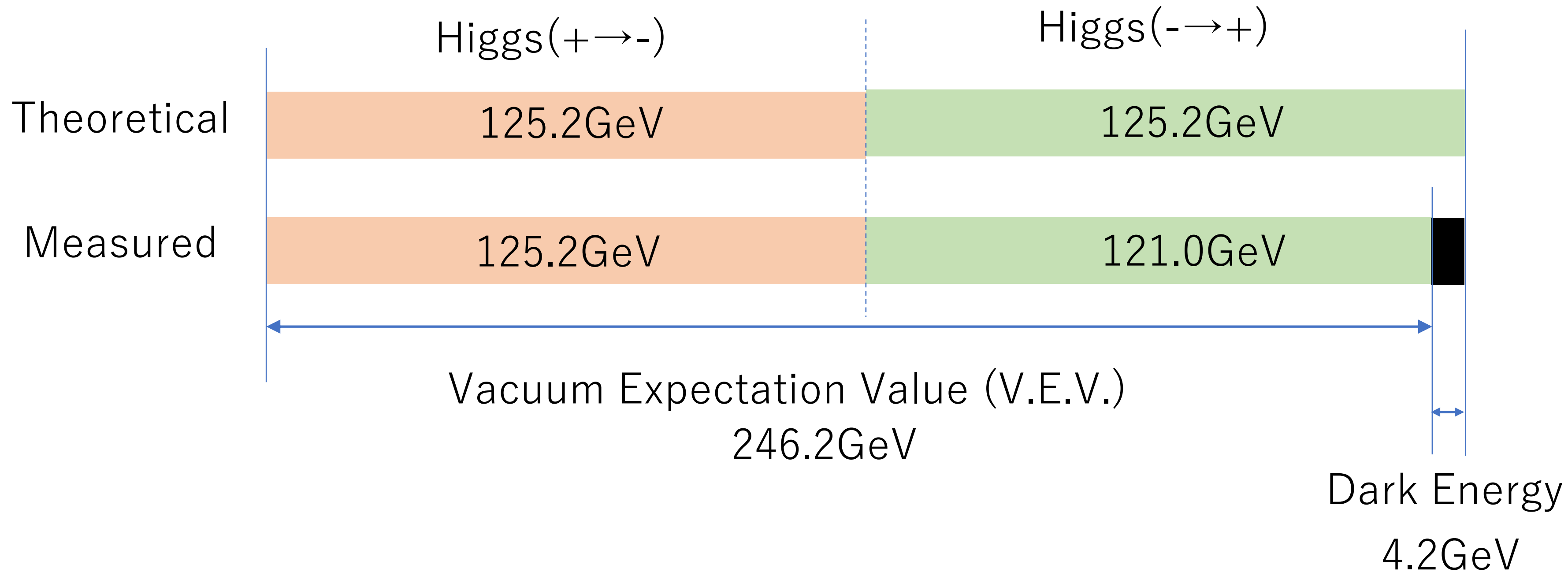
$$\Delta M_{32}^2 \quad = 2.47 \times 10^{-3} (eV/c^2)^2 \qquad 2.46 \times 10^{-3} (eV/c^2)^2$$

$$M_3 = \frac{r^{-1}}{V_H^2} M_H \qquad = 0.0601 eV/c^2$$

Secondary mass (three particle collisions)

It is known that there are three mass states for neutrinos.
Although the absolute values have not been measured, the differences in mass have been measured.
If we assume a simple geometric progression, it matches the measured values well.
The radius used in calculating the masses of charged leptons is used.
The denominator is the square of the Higgs volume.
This suggests that the mass is secondary.
For example, primary mass corresponds to the collision of a particle with the Higgs particle.
With secondary mass, mass is only produced when three particles collide.

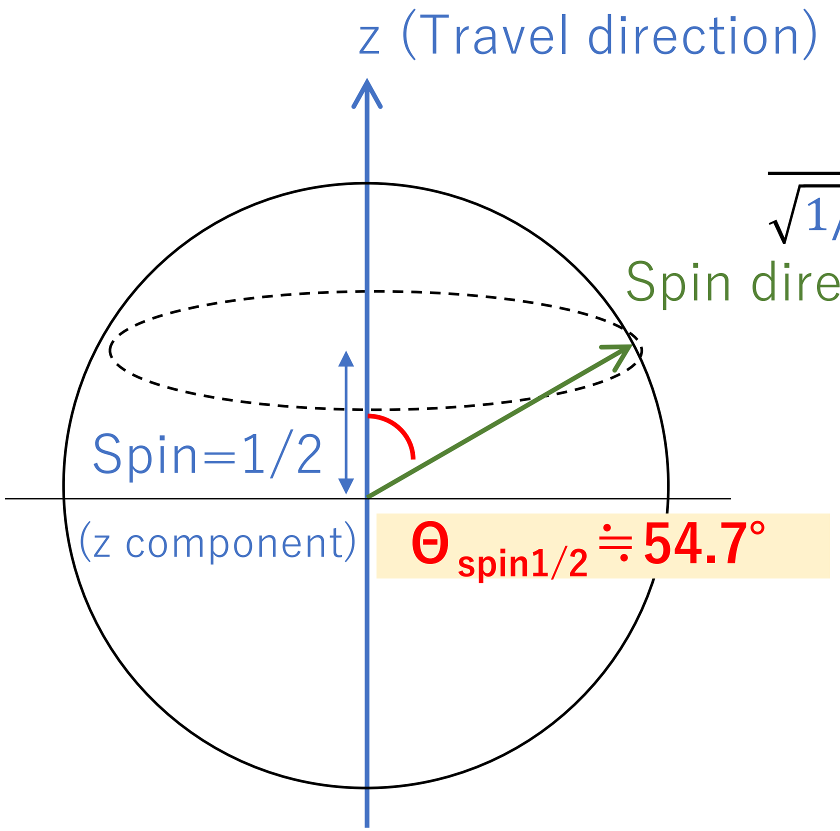
Vacuum Expectation Value



Asymmetry of vacuum $$a_{VEV} = \frac{2M_H c^2 - V.E.V}{M_H c^2} = \frac{4.2}{125.2} = 3.35\%$$

Previously, we stated that two types of Higgs particles are needed, one from positive to negative and one from negative to positive.
The degree of aggregation of Higgs particles in a vacuum has been measured as the vacuum expectation value.
As expected, the vacuum expectation value is about twice the Higgs mass, but there is a slight difference.
The values would match if one of the Higgs particles were reduced by a few percent.
If this is not an error, then the vacuum is asymmetric.
Asymmetry is equivalent to energy.
We can predict that this energy that the vacuum possesses is dark energy.
This asymmetry may be the reason why there is a difference of several percent between theoretical predictions and actual measurements.

Force attenuation by spin1/2



$$\frac{1}{\sqrt{1/2(1/2+1)}} = \frac{\sqrt{3}}{2}$$

$$cos\Theta_{spin1/2} = \frac{1/2}{\sqrt{1/2(1/2+1)}} = \frac{\sqrt{3}}{4}$$

$$= 0.433$$

Energy and asymmetry are equivalent.
The mass of the fermion should also be able to be calculated from symmetry.
The spin of a fermion is 1/2.
Therefore, the decay rate of the force due to spin is different from that of a boson.
The calculation was made as shown in the figure.

Tauon mass

$$cos\Theta_{spin1/2} \times M_H = \frac{\sqrt{3}}{4} M_H = 54.21 GeV/c^2$$

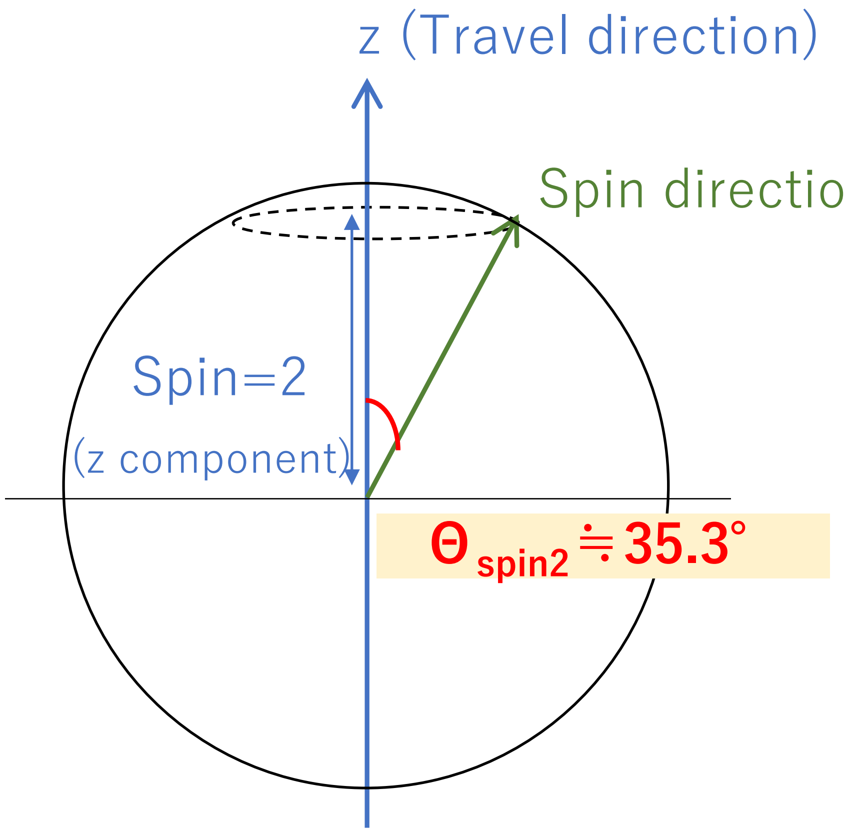
$$a_{VEV} \times cos\Theta_{spin1/2} \times M_H = 3.34\% \times \frac{\sqrt{3}}{4} M_H = 1810 MeV/c^2$$

$$M_\tau = 1777 MeV/c^2$$ (measured)

Due to the asymmetry of the vacuum,
the remaining Higgs that is not cancelled out becomes mass

Let's calculate the mass of a tauon.
We multiplied the Higgs mass by the damping rate due to spin 1/2.
This is an order of magnitude different from the measured value.
We then multiply it by the asymmetry of the vacuum expectation value.
This results in a value that is close to the measured value.
We predict that charged leptons become lighter due to Higgs cancellation.
However, if the Higgs in the vacuum are biased, they will not cancel out completely.
The part that remains uncancelled becomes the mass.

Force attenuation by spin2



$$\frac{1}{\sqrt{2(2+1)}} = \frac{1}{\sqrt{6}}$$

$$cos\Theta_{spin1/2} = \frac{2}{\sqrt{2(2+1)}} = \frac{2}{\sqrt{6}}$$

$$= 0.816$$

Next, we consider gravity.
The general theory of relativity predicts that the graviton has spin 2.
We calculated the attenuation of force when the graviton has spin 2 in the same way as before.

Coupling constant of gravitation

Gauge coupling constant of gravitation

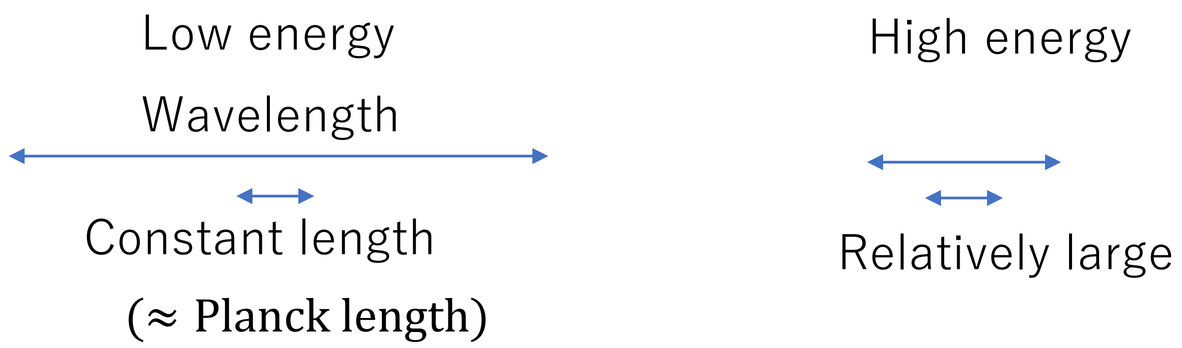
half-side spin2

$$g_G = \frac{1}{2} \times \frac{2}{\sqrt{6}} = \frac{1}{\sqrt{6}} = 0.408$$

We will calculate the gauge coupling constant of gravity.
Like electromagnetic force, gravity interacts with an indeterminate number of distant particles.
In this case, only half of the force interacts, so the strength of the force is halved.
We were able to calculate the gauge constant by multiplying it with the damping due to spin 2.
However, it is not separated into horizontal and vertical components to the sphere, as is the case with photons and Z bosons.
This is because if both forces reach infinity, they cannot be distinguished.

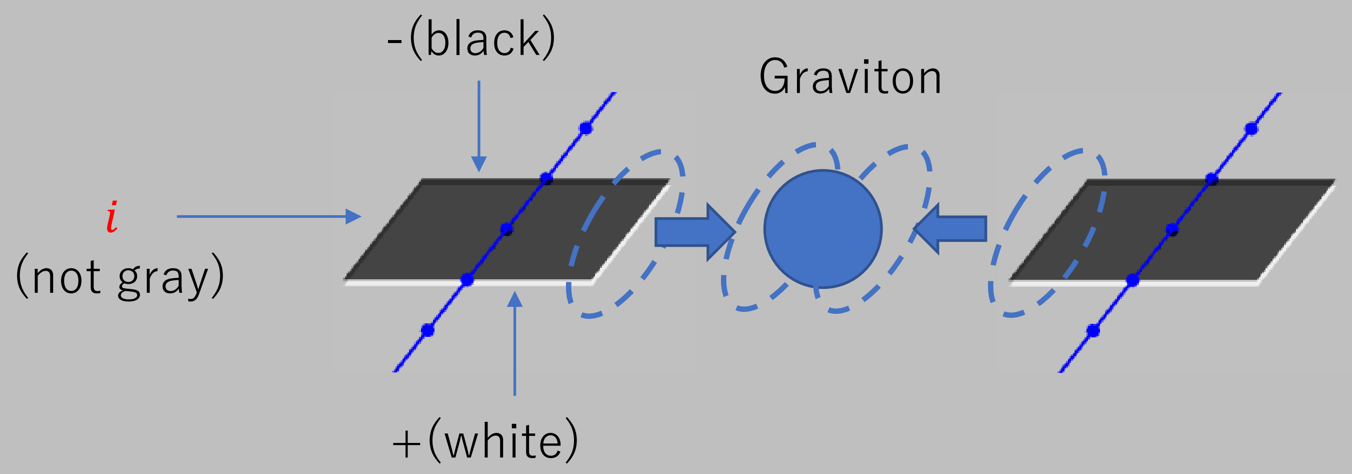
Nature of graviton

- The greater the energy, the stronger the force
- No repulsion, only attraction
- Massless and symmetrical in the direction of travel
- Rotate 180 degrees to return to the original (Spin 2)



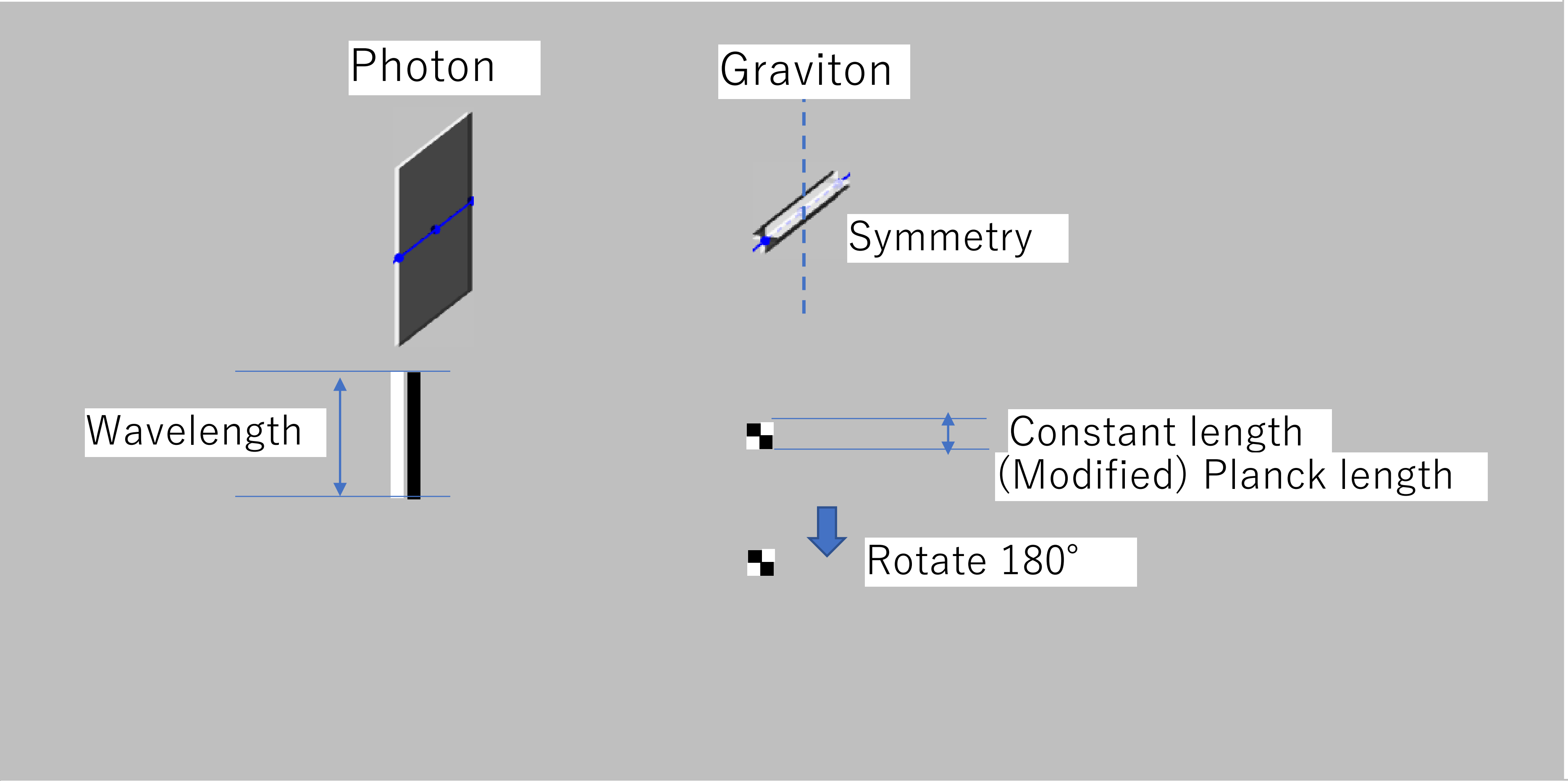
We can infer what gravitons are like from the following four properties.
The heavier and more energetic they are, the stronger their force.
There is no repulsive force, only attractive force.
Because they have no mass, they are symmetric in the direction of travel, like photons.
Because they have spin 2, they will return to their original shape when rotated 180 degrees.
Let's assume that something has a constant length, regardless of the wavelength.
The relative magnitude of that length to the wavelength increases as the wavelength becomes shorter.
If interference occurs along that length, the force becomes stronger along with the energy.
If the constant length is about the Planck length, it matches the actual strength.

Force acting on the cross section



If only gravity acts, it is the same as having no sign.
So, we think of it as cross sections, not white or black surfaces, that interfere.
Cross sections are not grey, but like imaginary numbers.
Cross sections interfere with each other and reinforce each other.
The gravitational forces that mediate this have cross sections.
The existence of cross sections rather than a vacuum is itself a kind of asymmetry.
The force acts in the direction that eliminates the asymmetry, so that electrical neutrality and whiteness.
If cross sections connect with each other, the cross sections disappear, and gravity acts in that direction.

Schema of graviton



A graviton can be imagined as shown in the diagram.
It has only a core of about the Planck length, regardless of wavelength.
It has no surfaces, only cross sections.
Like photons, it is symmetric in the direction of travel.
A 180 degree rotation returns it to its original shape.
Because it has no surfaces, I think both the vertical and horizontal components can be mediated by the same graviton.

Planck scale

Planck length $$l_P = \sqrt{\frac{\hbar G}{c^3}} = 1.616 \times 10^{-35} m$$

Let us introduce the Planck scale.
The Planck length is the length at which the Compton wavelength divided by pi is equal to the Schwarzschild radius.
When the wavelength is about the Planck length, the strength of gravity is comparable to other forces.
To be precise, it is the same strength as a force with a gauge coupling constant of 1.

Modified Planck scale

Planck length

Modified Planck length $$l_{P'} = \frac{l_P}{g_G} = \sqrt{6} l_P = \sqrt{\frac{6\hbar G}{c^3}} = 3.959 \times 10^{-35} m$$

Gauge coupling constant of gravity

Compton length

Higgs length $$l_H = \frac{\lambda_H}{2\pi} = \frac{\hbar}{M_H c} = 1.576 \times 10^{-19} m$$

Higgs mass

The gauge coupling constant of gravity has already been calculated.
We will calculate the scale at which the strength of gravity becomes that gauge coupling constant.
We will call this the modified Planck scale.
The modified Planck length corresponds to the cross-section of the particle, or the size of the graviton.
This is a natural unit, but there is another natural unit that can be considered.
We will call the scale of the Higgs particle the Higgs scale.
The Higgs length is the Compton wavelength of the Higgs particle divided by 2π.

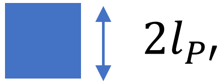
Hierarchy

Surface Area of a cylinder

Compton wavelength — Higgs length

Hierarchy $W = \frac{\lambda_{P'} \times \lambda_H}{r_{P'}^2} = \frac{2\pi l_{P'} \times 2\pi l_H}{(2 l_{P'})^2} = \pi^2 \frac{l_H}{l_{P'}} = 3.929 \times 10^{17}$

Schwarzschild radius — Modified Planck length



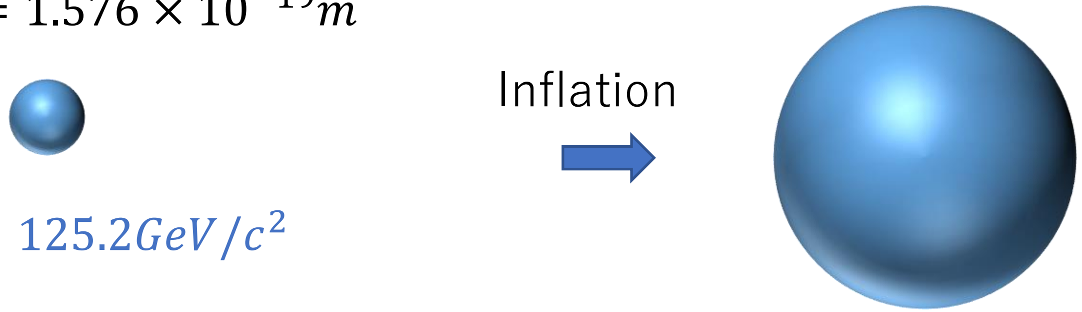
Area of a square

The modified Planck length and the Higgs length are significantly different orders of magnitude, and there is a hierarchy.
To represent this hierarchy, we define a dimensionless quantity denoted by W.
The denominator is the square of the Schwarzschild radius on the modified Planck scale.
This is the area obtained by square twice the modified Planck length.
The denominator is the product of the Higgs Compton wavelength and the modified Planck Compton wavelength.
This is the surface area of a cylinder.
The area ratio can also be interpreted as the number of states in which the smaller area is chosen from the larger area.
We have defined it this way because it can explain a variety of things empirically.
It is a simple length ratio multiplied by pi squared.

Inflation and dark energy

$r = l_H = 1.576 \times 10^{-19} m$

$r' = W \times l_H = 0.6193 m$



$M_H = 125.2 GeV/c^2$

$V' = \frac{3}{4}\pi(W l_H)^3 = 0.9984 m^3$

$a_{VEV} \times \frac{M_H}{V'} = 7.49 \times 10^{-30} g/cm^3$

$5.83 \times 10^{-30} g/cm^3$

Dark energy (Actual measurement)

$a_{VEV} = \frac{2M_H - V.E.V.}{M_H}$

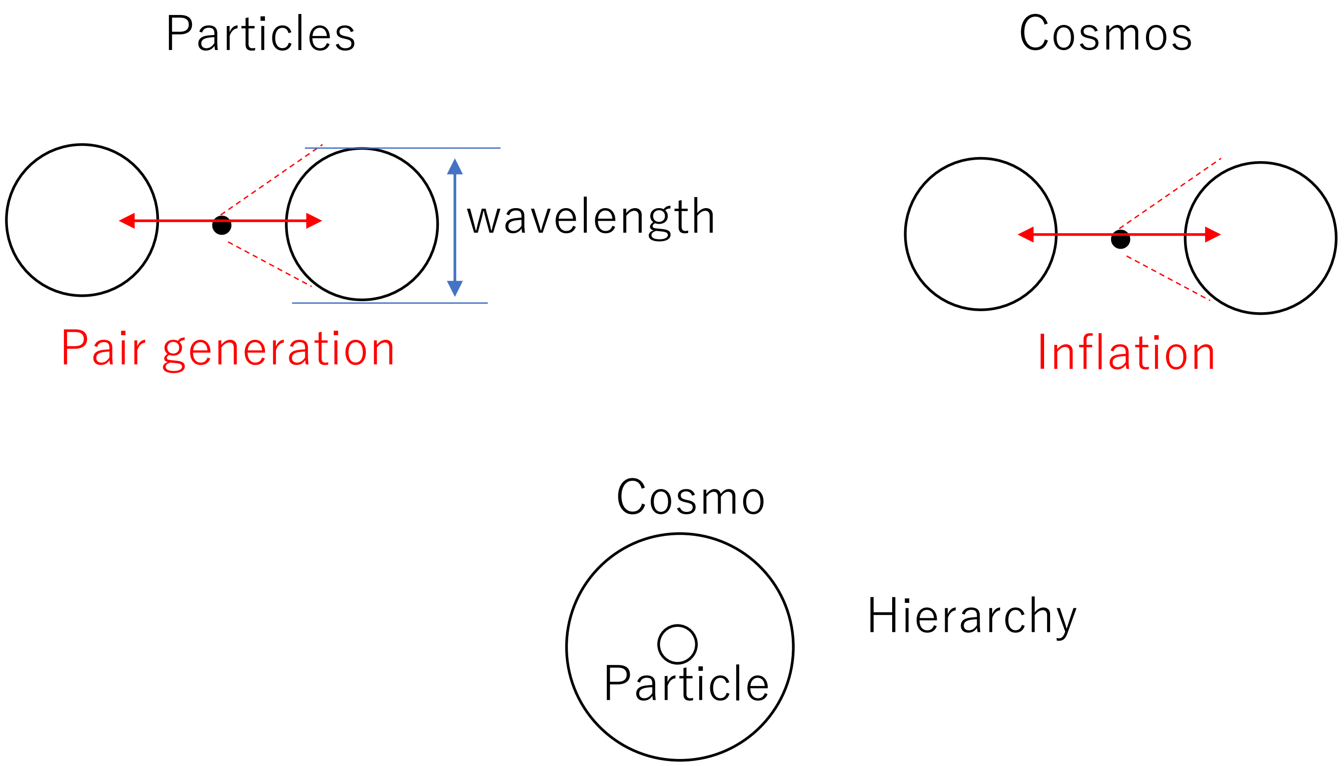
Let's consider the beginning of the universe.
Suppose at the beginning, a sphere with a radius equal to the Higgs length possessed the energy of the Higgs particle.
Suppose that this length was inflated by a factor of W, which represents the hierarchy.
Dividing the energy by the volume of the sphere gives the energy density.
Multiply this energy density by the asymmetry of the vacuum expectation value.
The energy density now has a value close to the actual measured value of dark energy.
Dark energy can be interpreted as having been diluted by inflation.
Gravity can also be interpreted as acting on the asymmetry that existed before inflation.

Before phase transition

		Conventional theory	This theory
Number of force	Before phase transition	1	The type of asymmetry is necessarily determined
	After phase transition	4	
Strength of forces	Before phase transition	Unified	Since the origin is a different asymmetry, there is no need for them to be the same
	After phase transition	Branched	
Rest mass	Before phase transition	None	In order for the waves to not disappear, it is necessary
	After phase transition	Exist	

Let's consider physics in the early universe, before the phase transition.
In conventional theories, the strength of all forces is unified.
However, if each force originates from a different asymmetry, they do not need to be the same.
Rather, it is unnatural to have multiple forces of the same strength for no reason and for them to be redundant.
It may seem beautiful for a single force to branch, but it is not.
If one force was sufficient in the early universe, and it branches out, there needs to be a rational reason.
It is also thought that before the phase transition, the Higgs did not condense and rest mass did not exist.
However, if the Higgs is necessary to prevent waves from disappearing, then it is necessary even before the phase transition.

Analogy between cosmos and particles



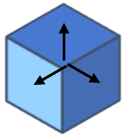
The universe and particles are similar, and an analogy can be made.
Particles have a length called a wavelength.
However, before a particle is created, its wavelength is 0.
Immediately after it is created, the wavelength changes from 0 to a constant value.
If this were to happen continuously and instantly, it would be the same as inflation.
Conversely, if we think of the universe as also being pair-created, the asymmetry can be explained.
A rational explanation for the existence of hierarchy is that there are particles in the universe.

Entropic hierarchy

Entropy $S = k_B lnW = 40.512 \approx \frac{81}{2}$ k_B : Boltzmann's constant =1

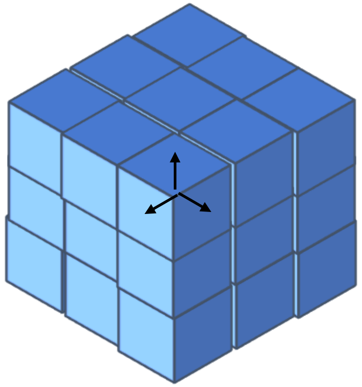
$S = \frac{E}{T}$ $E = \frac{1}{2} N k_B T$ Law of equipartition of energy

Degree of freedom $N = 2lnW \approx 81 = 3^4$



$N = 3$

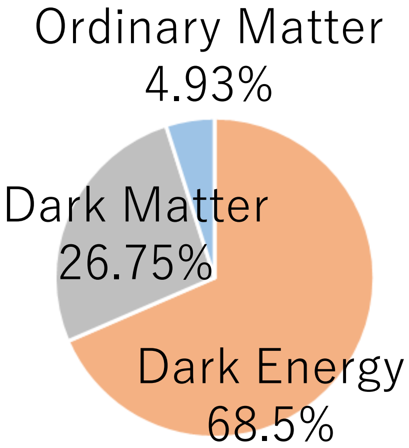
Inflation



$N = 3 \times 3^3$

The definition of the hierarchy W can be interpreted as the number of states where a smaller area is chosen from a larger area.
When this number of states is converted to entropy, it can be approximated as an integer ratio.
Entropy is a physical quantity obtained by dividing energy by temperature.
There is a law of equipartition of energy regarding entropy.
When we calculate the degrees of freedom from these equations, we get the fourth power of three.
Suppose there are three degrees of freedom in three-dimensional space.
We can imagine that there are 3 x 3 x 3, a total of 27 states.
Perhaps inflation changed the cube into something like a Rubik's Cube.

Dark matter ratio



$$\frac{OrdinaryMatter}{OrdinaryMatter + DarkMatter} = \frac{4.93\%}{4.93\% + 26.57\%} = 15.7\%$$

$$\frac{1}{\sqrt{lnW}} = \frac{1}{\sqrt{40.512}} = 15.7\%$$

$$\left(\frac{OrdinaryMatter}{OrdinaryMatter + DarkMatter}\right)^2 = \frac{1}{40.825} \approx \frac{1}{lnW}$$

The ratio of normal matter to dark matter in the universe has been observed.
The inverse of the square root of the natural logarithm of the hierarchy W equals that ratio.
This makes squaring the whole easier to interpret.
It represents the probability that when two particles meet in the universe, both are normal matter.
If this is determined by W, then the ratio of dark matter was determined by inflation.
In that case, the ratio of dark matter is constant after inflation.
It is thought that either reactions that change the ratio are not allowed, or the reverse reaction occurs with the same frequency.

Baryon number

$$\frac{Baryons}{Photons} = 6.04 \times 10^{-10}$$

$$\frac{Quarks}{Photonos} = \frac{3 \times Baryons}{Photons} = 1.81 \times 10^{-9}$$

$$\frac{1}{\sqrt{W}} = 1.60 \times 10^{-9}$$

$$\left(\frac{Quarks}{Photons}\right)^2 = \frac{1}{3.05 \times 10^{17}} \approx \frac{1}{W}$$

The baryon number in the universe is observed as a ratio to the number of photons.
As a baryon is made up of three quarks, multiplying it by 3 gives the number of quarks.
The inverse of the square root of the hierarchy W is a close value.
Squaring the whole makes it easier to interpret.
It can be interpreted as the probability of two particles being created such that the sum of the quark numbers is not zero.
If this is determined by W, then the baryon number was determined by inflation.
In that case, the baryon number remains constant after inflation.
It is thought that reactions that change the ratio are not allowed, or that the reverse reactions occur with the same frequency.

Observable universe energy

$$lnW = 2.0006 \times \left(\frac{9}{2}\right)^2$$

$$lnW' = 2.0006 \times \left(\frac{9}{2}\right)^3$$

$$W' \times M_H = 3.3 \times 10^{54} kg$$

$$1.5 \times 10^{53} kg \quad \times \frac{1}{4.93\%} = 3.0 \times 10^{54} kg$$

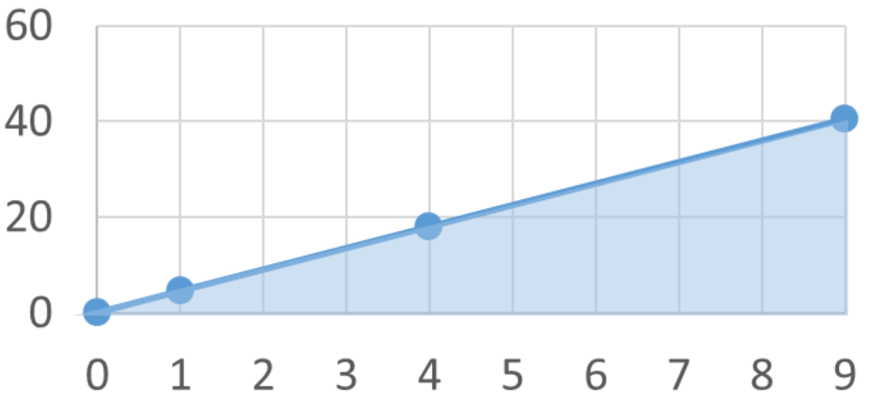
Ordinary matter of observable universe

Ratio of ordinary matter

All energy of observable universe

The natural logarithm of the hierarchy W can be approximated by an integer.
Let's change the squared part to a cube.
Let's multiply that by the mass of the Higgs particle.
We get a value that is close to the total mass of the observable universe.
However, this also includes dark matter and dark energy.
It is unclear what 9/2 represents.
It could just be a coincidence.

Numerology



3^2

Height $= lnW$ (Length hierarchy)

Area $= lnW'$
(Universe/Higgs hierarchy)

Slope $\approx \frac{9}{2} = 4.5$

$\frac{3^2}{2} = 4.5$ $3ln\pi^2 = 4.5002$ $\pi + \frac{e}{2} = 4.5007$ $\pi + \frac{1+\sqrt{3}}{2} = 4.5076$

Here is a graph of the two hierarchies.
The height is the natural logarithm of the length hierarchy W.
The area is the hierarchy of mass in the observable universe.
The slope is 2/9.
There are many other ways to express a value close to 2/9 using other numerical values.
However, the formula would be meaningless unless you can imagine it in a physically meaningful way.

Geometric lepton mass list

	Geometric			Volume	Mass		
	z	x	y	$V = xyz$	$\frac{V}{V_H} M_H$	M	
e	1			1	0.503	0.511	MeV/c^2
μ		$2\pi r$		$2\pi r$	106.0	105.7	MeV/c^2
τ		πr^2		πr^2	1.780	1.777	GeV/c^2
H	$\frac{2\pi r}{3}$	πr^2		$V_H = \frac{2}{3}\pi^2 r^3$	$M_H =$	125.2	GeV/c^2
ν_1	$\frac{1}{r^2 V_H}$			$\frac{1}{r^2 V_H}$	0.0018		eV/c^2
ν_2		$\sqrt{r}$		$\frac{1}{r^{1.5} V_H}$	0.0104		eV/c^2
ν_3		r		$\frac{1}{r^1 V_H}$	0.0601		eV/c^2

This is a summary of the masses of leptons.
The collision volume with the Higgs is an empirical geometric estimate.
The radius r is a value determined to satisfy the Koide formula.
The volume is constrained to be the product of the lengths in the X, Y, and Z directions.

Geometric quark mass list

	Geometric			Volume	Mass		
	z	x	y	$V = xyz$	$\frac{V}{V_H} M_H$	M	
d	9			9	4.5	4.7	MeV/c^2
s		$\frac{1}{3\sqrt{3}} 2\pi \left(\frac{1}{2} r\right)$		$\sqrt{3}\pi r$	92	94	MeV/c^2
b		$\pi \left(\frac{1}{2} r\right)^2$		$\frac{9}{4}\pi r^2$	4.01	4.18	GeV/c^2
u	$\frac{9}{2}$			$\frac{9}{2}$	2.3	2.2	MeV/c^2
c		$\frac{1}{\sqrt{3}} 2\pi \left(\frac{9}{2} r\right)$		$\frac{81}{2\sqrt{3}}\pi r$	1.24	1.27	GeV/c^2
t		$\pi \left(\frac{9}{2} r\right)^2$		$\frac{729}{8}\pi r^2$	162	173	GeV/c^2

I tried to see if I could express the mass of quarks in terms of volume ratios, just like I could with leptons.
From my experience, I came up with the table below.
There seems to be some kind of law behind the coefficients, such as 2/9.
But it could just be a coincidence.

Asymmetric mass list

	Asymmetry				Mass		
	Spin ×	Sphere ×	Uncancelable =	a	aM_H	M	
H	1	1	1	1	$M_H =$	125.2	GeV/c^2
Z	$\frac{1}{\sqrt{2}}$	1	1	$\frac{1}{\sqrt{2}}$	88.5	91.2	GeV/c^2
W	$\frac{1}{\sqrt{2}}$	$cos30°$	1	$\sqrt{\frac{3}{8}}$	76.7	80.4	GeV/c^2
τ	$\frac{\sqrt{3}}{4}$	1	a_{VEV}	$\frac{\sqrt{3}}{4}a_{VEV}$	1.81	1.78	GeV/c^2

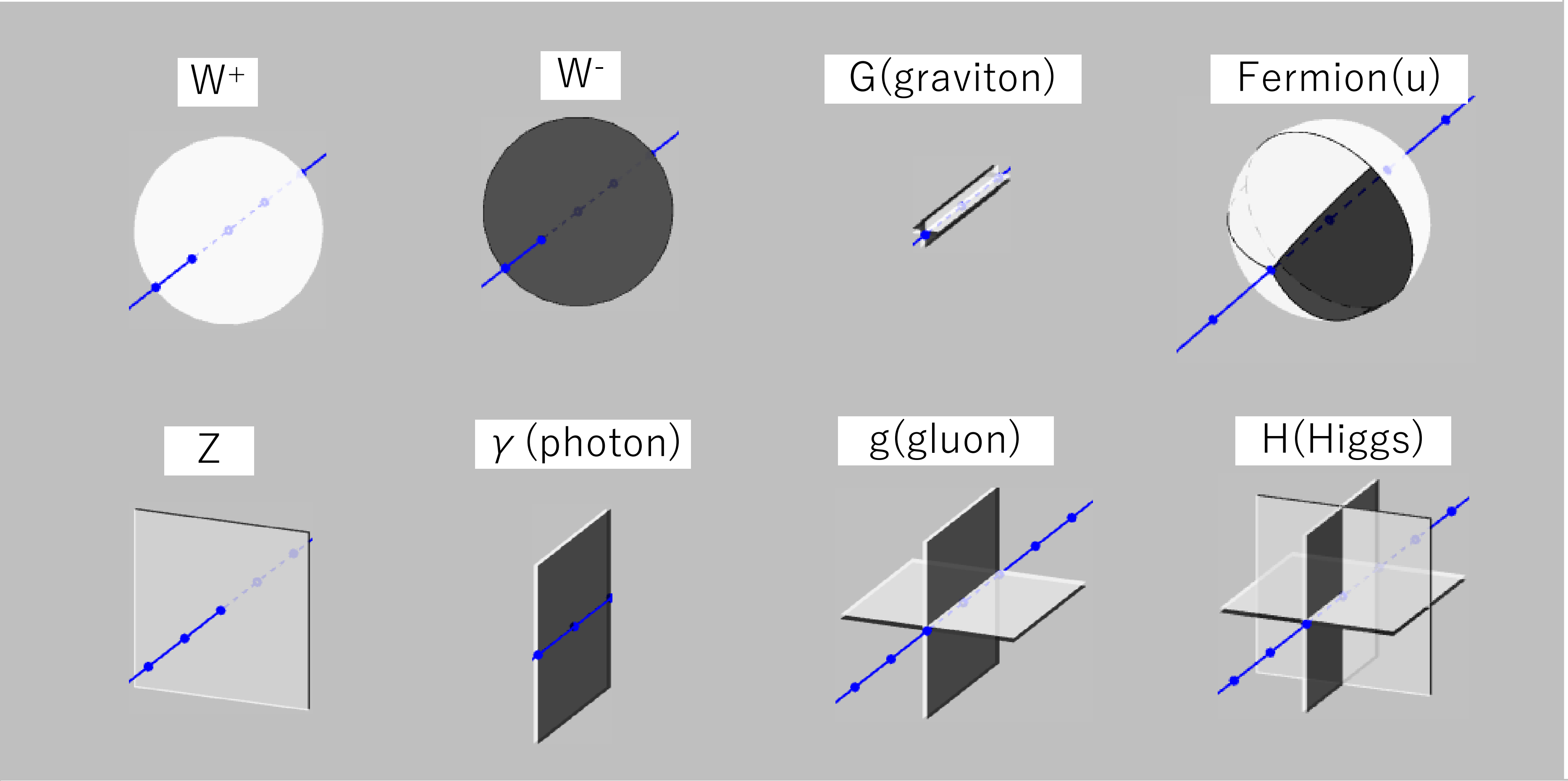
We have calculated the masses from the asymmetry.
So far, we have only been able to calculate for some particles.
For other particles, it is thought that more complicated calculations will be necessary.
In addition, we have not been able to calculate the mixing angles of quarks and neutrinos.

All force list

	Asymmetry					Gauge coupling constant	
	direction	source	Attenuation				
			× half	× spin	× sphere	= a	measured
H	Space move	1	1			1.000	
g	Rotation	1(color)				0.333	0.344
		1/3 (Y)				1.000	
W	Time move	1/2 (T)	1	$\frac{1}{\sqrt{2}}$	cos30°	0.612	0.630
Z					1	0.707	0.618
	Radial	1 (Q)	$\frac{1}{2}$		sin30°	0.177	0.166
γ					cos30°	0.306	0.303
G	Corss section	1		$\frac{2}{\sqrt{6}}$	1	0.408	

We have summarized all the force asymmetries and gauge coupling constants.
For gluons, we have shown both the case where the standard is a color charge of 1 and the case where the standard is a 1/3 sphere.
Z distinguishes between the forces acting on charge and isospin.
All values are close to the actual measured values, but they do not match precisely.
The strength of the force changes with the energy scale, but calculations that take this into account have not been performed.
There is no necessity for the strength of all forces in the energy of the early universe to be the same.
In fact, it would be unnatural for different phenomena, such as rotation and motion, to be the same.
There is no need to introduce supersymmetry to adjust the strength of the force.

Schema list



We have put together a schematic diagram of particles.
The up quark is shown as a representative fermion.
It simply shows the phase direction, and does not actually have this shape.
It has a simple three-dimensional shape, does not overlap, and can represent a variety of particles.

Solved and Unsolved

Solved

- The four forces and masses could be interpreted as the result of interference, without any clear contradiction to the Standard Model.
- Theoretical values for the gauge coupling constants and other parameters did not deviate significantly from the measured values.
- Without free parameters, the theory could be explained as a physical image, not just a mathematical formula.
- Assuming the principle of standing waves, everything could be derived from first principles.

Unsolved

- The actual measured values cannot be accurately estimated.
- Uncertainties remain about gravity, mass, and mixture ratios.

Here's a summary of what's been resolved and what remains unresolved.
The four forces and masses could be interpreted as the result of interference, without any clear contradiction to the Standard Model.
Theoretical values for the gauge coupling constants and other parameters did not deviate significantly from the measured values.
Without free parameters, the theory could be explained as a physical image, not just a mathematical formula.
Assuming the principle of standing waves, everything could be derived from first principles.
The actual measured values cannot be accurately estimated.
Uncertainties remain about gravity, mass, and mixture ratios.

Researcher

- This research was carried out as a volunteer activity in 2024.
- An unnamed researcher of artificial general intelligence participated.
- The purpose was to prepare for research the theory of everything by artificial general intelligence (AGI).
- The activity has now ended.
- This research will be taken over by artificial general intelligence (AGI).

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Comparing theories

<table>
<tr><th></th><th>(typycal) Superstring theory</th><th>Interference theory</th></tr>
<tr><td>Particle</td><td>String that exist in 10D space</td><td>3D space that direction changed
(3D map of vectors)</td></tr>
<tr><td>Number
of forces</td><td>Determined by the
number of dimensions, etc.</td><td rowspan="3">It is necessarily determined to
prevent disappearance of wave
(no redundancy)</td></tr>
<tr><td>Strength
of forces</td><td>Uniform in the early universe</td></tr>
<tr><td>Rest mass</td><td>It is not necessary
(Did't exist in early universe)</td></tr>
<tr><td>Super
symmetry</td><td>Necessary</td><td>Not necessary</td></tr>
<tr><td>researcher</td><td>Physicist (human)</td><td>Artificial General Intelligence(AGI)</td></tr>
</table>

Finally, we compared it with representative conventional theories.
String theory is mathematically simple and beautiful, as its only constraint is that it is a string.
In terms of physical necessity, I think interference theory is more beautiful.
This table does not indicate which theory is superior or inferior.
I believe that getting ideas from different theories will lead to better theories.
If people turn their attention to new theories, I believe we are close to completing the theory of everything.

Reference

The Review of Particle Physics (2024)
S. Navas et al. (Particle Data Group), Phys. Rev. D 110, 030001 (2024)
Particle Data Group https://pdg.lbl.gov/

Various values were taken from the 2024 edition of the Particle Data Group.
Only information that is freely available to anyone on the Internet was used as reference.

Afterword

The idea of interpreting force as interference
allowed all the pieces of the puzzle to fit together beautifully.

I'm eternally grateful to all the physicists who have built physics,
and to the physicists of the future who will complete the theory of everything.

Contact: ai@ultagi.org https://ultagi.org/

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