0. Overview

the heartbeats of my model

1. bound objects

If we conceive particles as spun from higher-energy physics, then that viewpoint fundamentally alters the nature of particles.

Instead of being regarded as simple, point entities we ought to regard them as elements of a higher-physics environment. In their interactions with other members within this environment, they have become immune to change from this environment. Some, set of things have formed preservative, contractual relationships with each other which have created the particles within our lower energy physics.

By, the formation of these contracts they have also frozen in the nature of these particles.

This leads to a twofold conception of present forces:

1. they preserve past contracts and attributes[1]

2. they lead to exchanges of energy between our present particles[2]

This expains why discrete, quantum numbers might be preserved in interactions. As well, the first point leads to a natural conception of a high-energy desert, at energies lower than the freezing in of particle properties.

[1] as this is what they have come about to do
[2] that relate our particles to one another and our common causal worldline

2a. Let us take the concept of experiment seriously

That is to acknowledge that experiments are not simple.

Naively they seem impossible to do. How can we exclude the effects of phenomena not under consideration from our experiment without knowing all phenomena. To know any part of the world it seems we must know the whole world.

The shift from excluding all phenomena not under consideration to excluding all **relevant** phenomena not under consideration is one worth thinking about.

However, we **do** seem able to do experiments. **And we should take it that we can.** Why?

1. repeatable behaviour occurs.
2. we can wrap objects around environments which can reflect away phenomena that is unwanted or alter themselves to resist these phenomena leaving our essential behaviour unaffected
3. we use reconciling items e.g. "in the absence of ...." , "under the assumption that..." "keeping pressure constant..."

2b. reconciliation

Let us focus on the third point, reconciling items.

Our theories of the motions of objects continually improve, by eliminating reconciling items by including their nature within our models. We thus arrive at better and better theories of the 'true' motion of particles.

Must this process either endlessly progresses or successfully terminate?

Perhaps not.

Two processes trouble me. How do we account for

a) the capture and release of theoretical elements that start and stop their motions

b.) how do we measure the behaviour of these theoretical elements.

But, rather than fall into a philosophical morasse about the impossibility of 'truly' knowing our elements, I suggest we simply take it that we can. and we can because our theories come in pairs.

The processes of start and stop and measurement of one field is told told by the motions of the opposing field. And the process of of start and stop and measurement of the opposing field is told

3a. The simple entities philosophy

The entities within our physical theories are simple. They lie upon our worldline following paths with a definite position and momentum, or are comprised of a field of smaller entities which follow such paths.

Consequently all physical behaviour is explained by either the mechanics of our field theory (the motions of particles) or by our ability to externally individuate its parts (the attributes of our particles)

Either we can know the path of our entities perfectly, or may localise them to mixtures of such behaviours. **Ignorance means mixture.** If we could measure better (though we may not be able to physically do so), our physics would be complete.

3b. simple entities and the equivalence principle

1. Let us take our particles as preceding our causal worldline.
2. Our common causal worldline is something formed by their behaviours and not a thing upon which they move.
3. A particle interacts causally by being localised to the wordline.
4. When localised to the worldline, some of its behaviour will present as motions upon the common causal worldline and some will appear as loops. The latter are the physical representation of the attributes of a particle.
5. The equivalence principle, as an epistemological principle within the simple entities philosophy, is this: by careful measurement we can discover the attributes of the particle, by measurement of motions on the worldline.
6. This philosophy ties together quantum mechanics and general relativity. In general relativity, the discovered property is intrinsic mass and not for example spin or color, but the principle remains the same.

This viewpoint serves as an underlying conceptual unification for quantum mechanics and general relativity. Which is useful to have because they look, on the face of it to be very different theories.

3a. Causality is a construct

1. Particles precede the common causal worldline, which is formed by their behaviour. Perhaps we can take it to be their average behaviour.

But, that common causal worldline serves a useful purpose. **It creates what we will perceive as the regular behaviour** and internal attributes of our particles, and it places them in external relation to one another via this common causal worldline.

2. We approach our particles from a measurement perspective

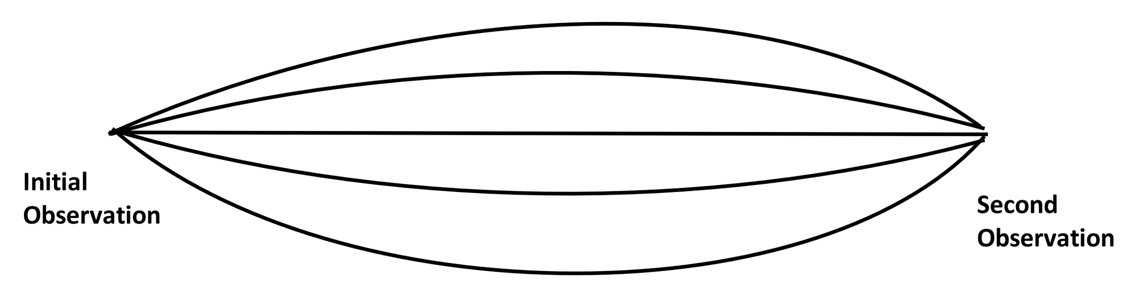
a.) **localisation:** we can only access them when localised to our common, causal worldline within some measuring device. This leads to the notion of entanglement.

b.) **probabilistic interpretation:** Our common causal worldline is a construct to which we localise ontologically existant particles. But, particles don't roll like a marble along a tabletop. In between causal localisations, we cannot hold them to a specific path along our worldline. They can travel freely (though bound by the preservation of certain causal attributes) consequently their motion is probablistic in nature localised to "somewhere on the wordline". As a bag might might capture the motions of a molecule within, so might we regard the entire universal worldline as a bag, which captures (probabilistically) our particles in their motions.

c.) **uncertainty principle:** we are only entitled to our measurements, not the behaviour which has delivered it to us.

Two conceptions of the motion of a particle

1. a paths conception:
When we measure some aspect of the regular behaviour of a particle **we cannot specify the particle which has delivered it to us.**
We are only entitled to the causal measurements upon our worldlines, and the causal restrictions upon our worldline that these must induce, there is no worldline path that our particles must follow. Measurements do not induce or produce history, and the situation does not resemble the measuring of the dimensions of a box.



5. Approach to unification

1. I will show that the simple entities philosophy underlies special and general relativity.

2. But, not in the same manner for quantum mechanics.

Our particles need not lie upon a worldline as our causal worldline is a construction. This gives rise to the localisation isssues that were resolved with the creation of quantum mechanics. But, the creation of discrete quantum numbers violates the simple entities thesis.

However these issue were resolved with the creation of the relativistic wavefunction and later quantum field theory. Accounting for the issues induced by the construction of our common, causal worldline quantum field theories obey the simple entities perspective.

3. While the simple entities thesis is sufficient to unify quantum mechanics and general relativity, it doesn't explain all the physical phenomena we have found. We have to extend the model via the entitential thesis. However, doing so, captures all other main aspects of physical phenomena and we end up with a reasonably robust theory. It works.

3b. Particles have ontological (real) existence

Isn't this stupid because there aren't any such thing as particles?

No. It took me a long time to see this. Our common causal worldline is a construct to which we localise ontologically existant particles. But, particles don't roll like a marble along a tabletop. Due to this, in between causal localisations, we cannot hold them to a specific path along our worldline. They can travel freely (though bound by the preservation of certain causal attributes). Their motion is probablistic in nature localised to "somewhere on the wordline", and is captured by a probability distribution over this wordline, which represents our chance of finding a particle when we apply a localisation procedure at a point on the common causal worldline.

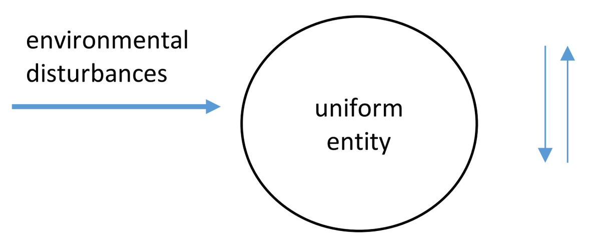
2. a bound objects conception:
We usually think of our particles as basic entities which construct larger entities. But lets take things as we find them.

We take as primary what we cannot differentiate any further.

This viewpoint focuses on our causal encounters with objects, and is useful in three aspects

1. localisation - as our causal worldline is a construct, what holds our particle to our causal worldline? We encounter them localised to consistent, causal entities and measure them by their effect on the same. And these causal containers are created by their relationships to one another.

2. contracts - How do entities relate to one another? How are our entities constructed? How do they come together to form new things? How were our present particles formed?



alerations in state
without an alteration in nature

e.g. a soccer ball when lying on the ground
or flying through the air, and being pushed by it,
remains the same thing

3. revision - if we take a causal, and not fundamental, perspective on our theoretical entities how do our interactions with the real world lead us to change our theoretical entities?

a bound object,
a set of behaviours counted as one entity

it is stable and
resistant to environmental disturbances

the environment no longer does work
upon the entity

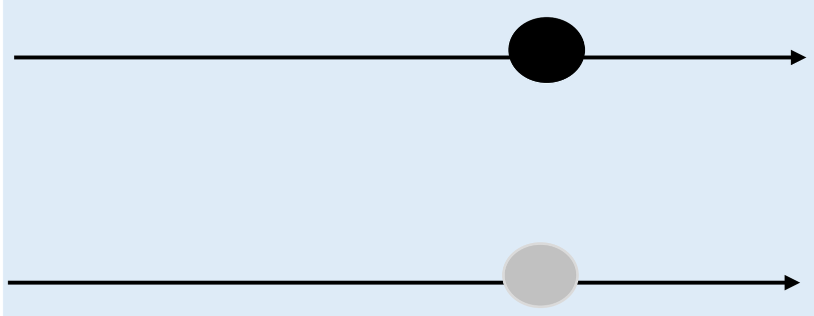
it has a constant nature: its various constituents have combined to form one uniform thing

it acts causally in a consistent manner

we often refer to irreducible bound objects as particles

1. the formation of particles

I. viewing a particle from a worldline
II. the formation of worldlines



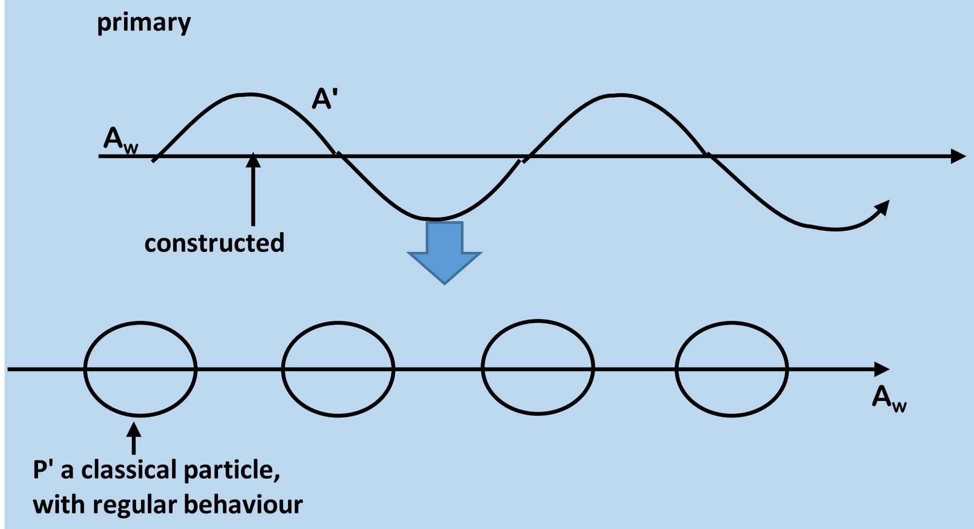
the common perception
a particle is an entity moving along our worldline and found at some place upon it.

the more accurate field (measurement) perspective
a field is an entity moving along our worldline and it provides a certain probability of finding a particle at some

probablistic interpretation
There are two perspectives at play here. From the perspective of the particles their paths are free and determined by their relations to one another. We do not have access to these interactions.

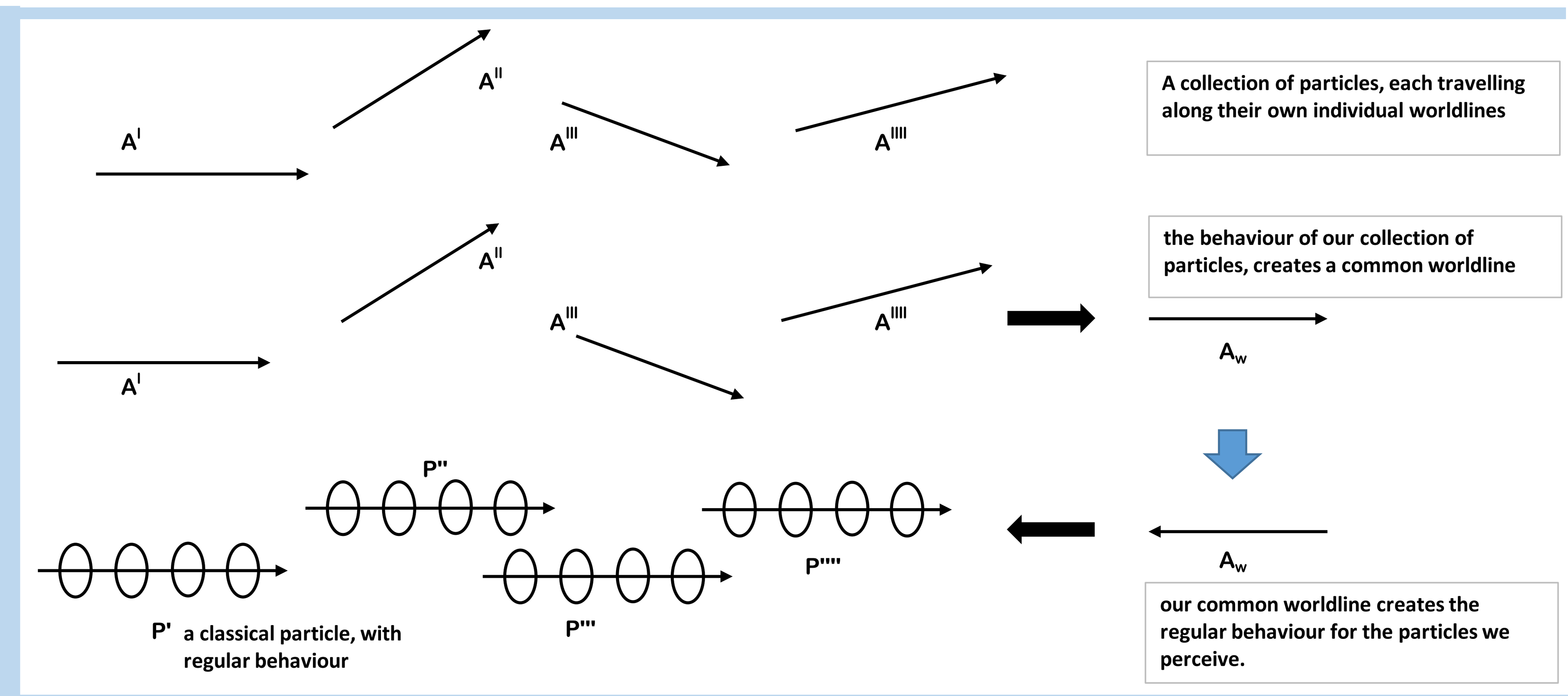
From our perspective atop the constructed causal worldline their behaviour is probablistic. We cannot localise particles to a single classical path between measurements.

Both perspectives are compatible with one another.



an alternate conception:
particles[1] are primary and
our worldline, or measuring manifold,
is something determined by them
creating what we will perceive
as the regular behaviour of our particles

[1] or other bound object, where by bound object we mean an entity counted as one, with a persistent character under various environmental fluctuations. It acts as one thing.



a better alternate conception:
particles[1] are primary and our worldline,
or measuring manifold, **is a construction**
that creates what we will perceive
as the regular behaviour of our particles

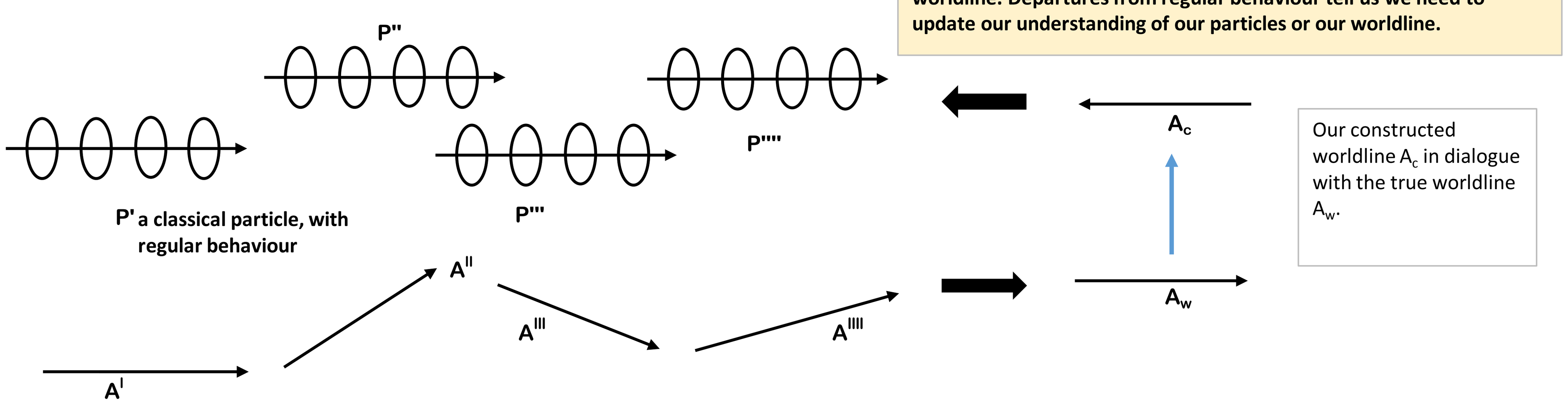
[1] or other bound object, where by bound object we mean an entity counted as one, with a persistent character under various environmental fluctuations.
it acts as one thing.

a worldline is causal
it is where entities interact with one another,

and its where we measure the nature of things
by their relation to one another

our worldline is a construction. something created
to reflect the regular behaviour we perceive
for our particles

But, this relationally determined worldline is in dialogue with our true worldline. Departures from regular behaviour tell us we need to update our understanding of our particles or our worldline.



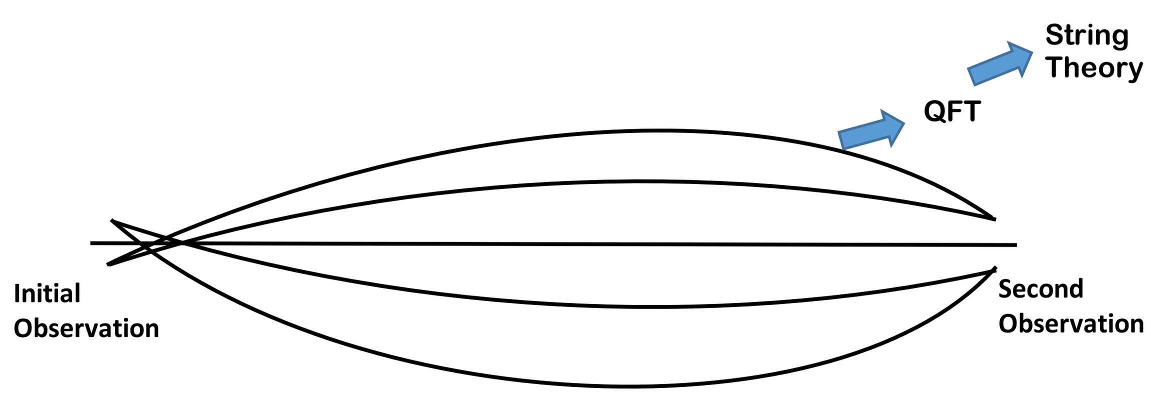
a paths conception:

Particles are primary and our worldline, or measuring manifold, **is a construction** that creates what we will perceive as the regular behaviour of our particles

But further, we are only entitled to our measurements upon this constructed worldline. When we measure some aspect of the regular behaviour of a particle **we cannot specify the particle which has delivered it to us.**

We are only entitled to the causal measurements upon our worldlines, and the causal restrictions upon our worldline that these must induce, there is no worldline path that our particles must follow.

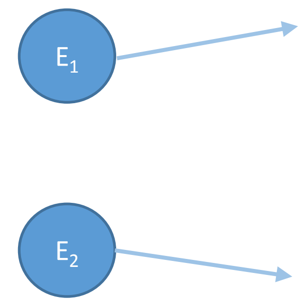
Measurements do not induce history, and the situation is not the same as measuring the dimensions of a box, before us.



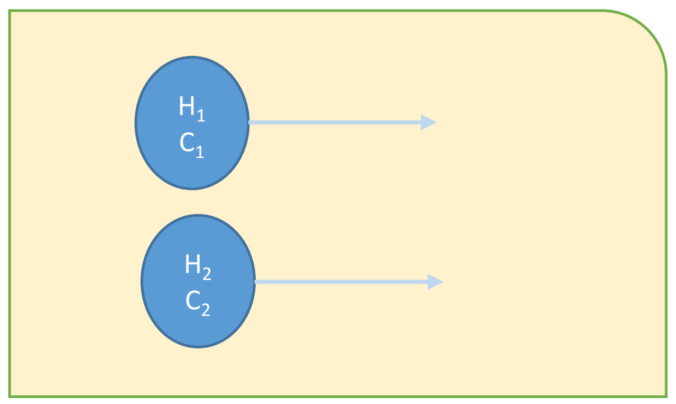
the curved lines represent free particle paths between these observations, obeying all relevant causal restrictions induced by the measurements and the nature of our particles as determined by our measuring manifold, the restrictions in motion it invariably and reversing consequently necessarily must obey.

B. 1 Entanglement

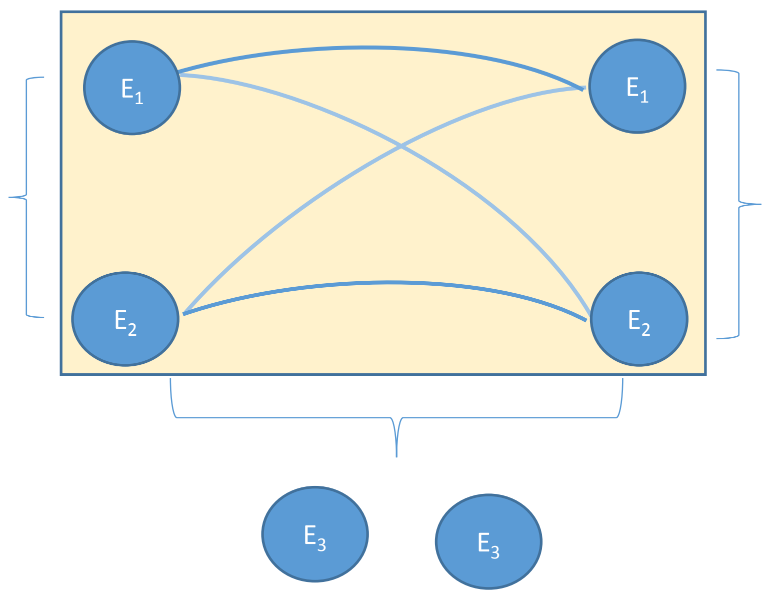
the creation of new entities which satisfy new algebras, which are not mixtures of our old entities.



a pair of entities with the same types of behaviour (witnessed by our experiments) each moving upon their own stationary state



a pair of particles with regular behaviours upon common stationary state



maintenance of contracts

maintenance of contracts

The curved lines represent free paths between the localisation of our particles by measurements to our worldline.

entanglement
the creation of a new pair of entities

Our new pair of entities E3 are something new. They do not represent mixtures of our old particles E1 and E2, but new paths that can result in the swapping around of our particles.

Mathematicall, we cannot decompose E3 into a mixture of E1 and E2 particles, with some of this mixture going to E1' because they were originally E1 particles and the rest going to E2' because they were originally E2 particles. The algebra of E3 does not factor into E1 and E2. And that was the problem behind bell inequality violations.

1. The simple entities (thermo-mechanistic) thesis

The entities within our physical theories are simple. They lie upon our worldline following paths with a definite position and momentum, or are comprised of a field of smaller entities which follow such paths.

Consequently all physical behaviour is explained by either the mechanics of particles, or their localisation to a container which is a mixture of such behaviours.

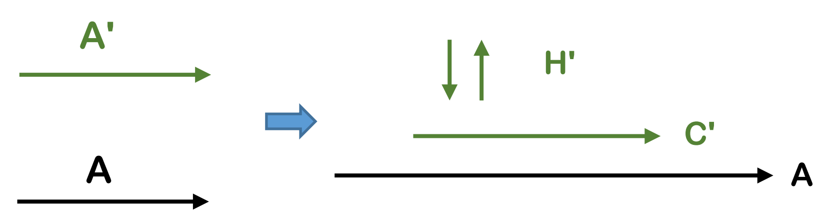
Ignorance means mixture. If we could measure better (though we may not be able to physically do so), our physics would be complete.

1. Commutative Algebras (EPR) Thesis
The algebraic structure applicable to measurements within our physical theories ought to be commutative.

Quantum mechanics breaks the simple entities philosophy of classical mechanics. And it does so, because for the first time the common, causal worldline cannot be taken to be an existant, absolute background.

2. the achn(sb) model

A CH



Each particle has two aspects, created by its relation to our common worldline. We call these it's c aspect and its h aspect.

Its c-aspect is its motion along our worldline and represents its causal arrow

Its h aspect determines its characteristics

These must sum to its worldline A'
A' = C' + H' (when measured from A's perspective)

One fundamental realisation:
the H aspect of a particle is not simple.

While the focus in gauge theory is on the c-aspect, on the causal motions and changes in these motions of some defined thing, it is worth paying attention to this h-aspect induced by the fact that causality is a construction and we can only encounter the world through bound objects.

The h-aspect of an entity contains the relational aspect of our entity. There are two senses to this.

Firstly, it contains **the contractual aspects of the entity:**

1. its **contracts** with other entities which structure its motions

2. the **localisation** of its constituents to its causal motion upon our common causal worldline

3. a certain **set of roles**, or ways of behaving, that our entity can perform, only one of which is active at a point in time.

Secondly, it contain **the ontological aspects of the entity, what makes it an entity**:

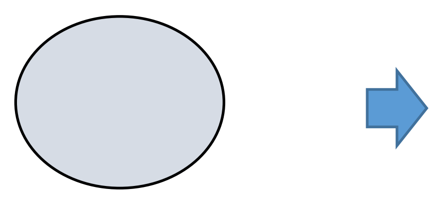
1a. reconciling items: influences and consequent changes to the

(cont.) An example would be impurity in a sample. We presume we are working with a pure sample. If contamination occurs we dont come up with a theory of contamination but adjust our results to remove the effect of the contamination from them. Consequently, if an unexpected result is obtained for a known item we must presume it was due to a change in our reconciling items, a change in conditions which have influenced our results.

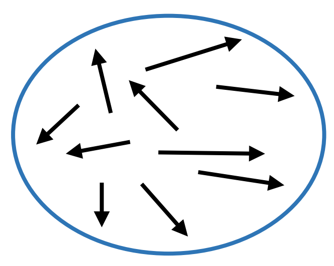
1b. reconciling items which count as energy. We encounter the unknown in terms of the known. Consequently, me measure the impact of a change in a reconciling item by its causal impact on our entity. One example is friction, the relationship between the material of our entity and the material of its environment, which we measure by its retardation of causal motion.

2. the counting of one of behaviour: the scale at which we encounter our entity. The setting of multiple iterations of our entity to one thing either because the changes have no causal effect that we are intererested with, or over the scale at which we encounter our entity, they sum to no causal effect.

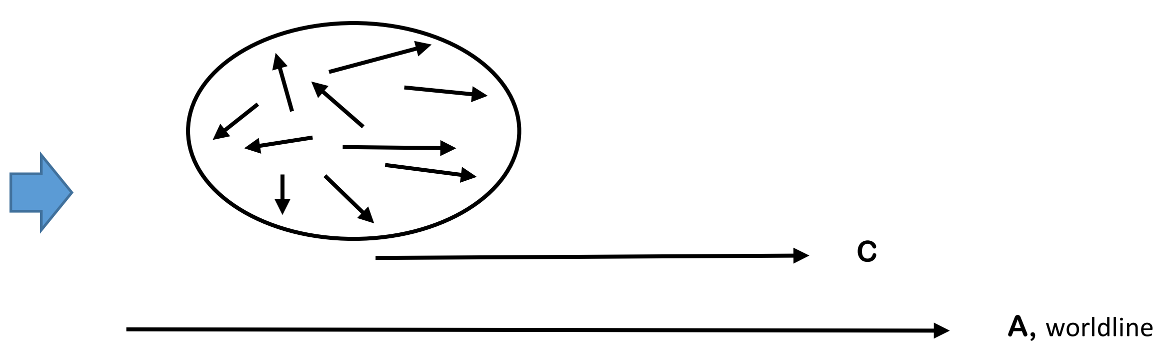
the ideas behind reconciling bound objects and ACHN(SB) objects



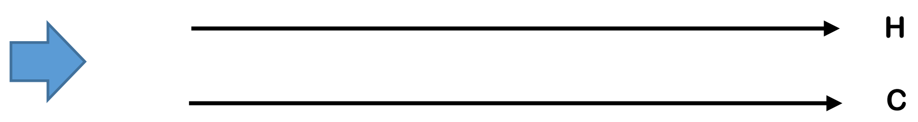
bound object



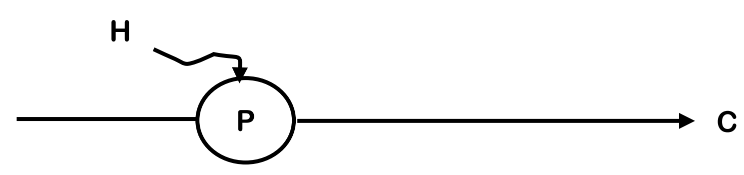
how each relational flow influences the entity[1]



we may regard our bound object as a bag with common attributes, moving along a worldline with a causal vector C [2]



parallel and preservative motion of the aspects of our entity as it travels along the worldline along its causal vector, maintaining its H attributes



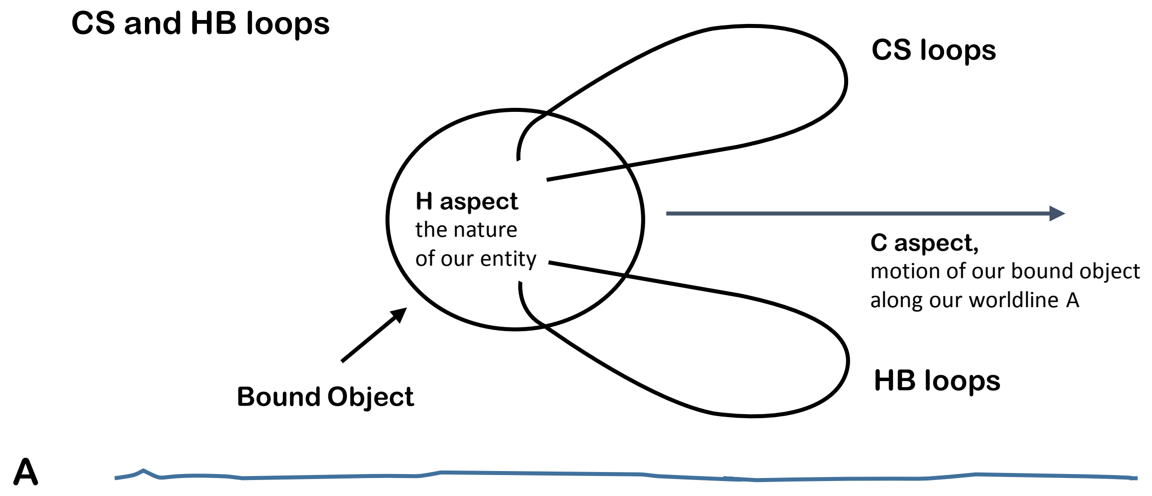
we commonly bulk the h-attributes of an entity into a particle, which we take to be moving along with a causal vector upon our worldline. Changes to its h-attributes induce causal changes to its motion.

[1] A bound object is an entity which under a set of influences remains the same thing.

A bound object in motion is an extension of the same concept: it moves in a myriad of ways, under various influences, but remains the same thing.

[2] Under its various influences a bound object can still have one defined causal motion. For example a ball rolling from point A to point B might be under the influence of many environmental factors which distort its motion, yet it still has one common causal vector, the others being small or offsetting one another or averaging out to null over the causal motion of the ball. The same ball might have a contractual relationship with the whole earth, which is mantained at a set level (of zero) by the level ground it rolls upon.
A bound object may also have a set of states it switches amongst. If we imagine our ball as composed of differently colored panels, then as it rolls one panel and one color will be topmost and we can regard our object as rotating through a set of color roles. Lastly it may be subject to various ontological influences

CS and HB loops



How does our entity carry along its characteristics or better, its h-sector with which we interact to discover these characteristics? If this is a sensible question to ask, where is the nature of a particle stored?

The physical entities we encounter tend not to be simple in two ways:

1. They contain things. For example a fermion seems to consist of bosons, with a specific example being an electron absorbing and emitting photons. Another would be an entity like the earth becoming more massive if something is added to it.

2. They interact with us through fields. The causal influence of an entity extends away from the entity itself. Our relation with these causal influence we regard as our forces.

So, one way to answer the question where is the nature of an entity, is to say that an entity is its causal field(s). This is a good answer, but let's modify it in three ways.

First of all let us immediately say that there are two kinds of loops: cs loops and hb loops[1]. Along a CS loop, the entities of the field can interact with other entities so that there is a net exchange of energy and momentum.

But along a HB loop no net exchanges of energy or momentum occur. There is no causal effect to this loop, except by those that may occur in interactions with another entity where no energy transfer occurs.

CS-HB equivalence
A CS loop which engages in no energy exchanges but returns to its emitting body as is, is an HB loop.

Unification
This split suggests a way of thinking of unification. HB loops capture average or unchanging and determined behaviour and form the base upon which our CS loops which create particular effects arise. Assuming that our models capture our world well, then QM which captures these particular aspects will capture the causal nature of the world and GR which captures the general aspects will capture the non-causal, co-determined nature of the entities in the world. GR captures the background upon which QM floats.

To speak of General Relativity we will fold our entities into bound objects without a causal aspect background which will interact in a determined, contractual manner with each other.

To speak of Quantum mechanics, we will take a particular fixed HB background and set of capturing bound objects and

And these flows can alter their nature in a causal manner. They need not be contractually co-determined.

Secondly, these loops are not as simple as they might appear because they are contractual in nature. The h-aspect of one entity relates to the h-aspects of other entities. And these relations structure the motions of these entities into bound objects.

The relation of our entities to others is complex with alterations to these relations altering our C-aspect motions or the nature of our causal CS loops. To understand the properties of our entities we must consequently understand their relations to one another, and their nature as bound objects. This is ekplored throughout the **c cs hb model**.

Lastly, we have to understand the concept of containment better. What does it mean for an entity to contain another, or to be composed of such? The localisation of entities to HB loops and their emission in CS loops is covered by the topic of **mediocrity**.

[1] or better two ways of viewing the interactions of the bodies that comprise an entity

3. C CS HB model (perfectly bound objects)

particles in motion, with their causal fields and fixed attributes

An entity moving along its c-path with h-attributes split into two types

CS

CS - causal flows
loops that that potentially engage in causal transfers of energy between this entity and others

HB

HB - attributes
the charges , attributes and fields of an entity

C

C - independent motions
the motion of our entities independent of their common structuring contract

particles engaging in contract formation

contracts already fixed

Entity 1
moving along its c-path with h-attributes

Entity 2
moving along its c-path with h-attributes

CS

CS - structuring contracts
loops that structure the motions of our entities

HB

HB - attributes
the charges , attributes and fields of an entity

C

C - independent motions
the motion of our entities independent of their common structuring contract

CS loops

Their heartbeat of CS loops is this: we no longer deal with particles as simple entities . Instead, we deal with particles as bound objects engaged in relations with other bound objects.

One part of this is the exertion of causal influence by one entity upon another. The other is the formation of a contract between entities. The first aspect leads to the principles behind the simple entities philososphy. But, CS loops have a dual character. Because due to them violations to the principles underyling the simple entities philosophy occur.

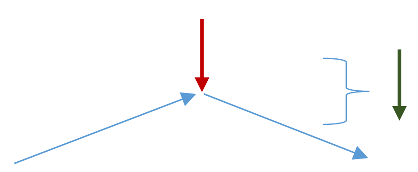
 # causality and contracts
0. heartbeats of causal interactions

1. form structuring contracts
loops that structure the motions of our entities into a bound object

 # causality and attributes
2. lead to the formation of hb loops
contracts immutable at a particular energy scale, which create the fixed attributes of an entity

3. **external individuation**: causal encounters with hb loops let us interact with the attributes related to them and by these encounters discovere the nature of these attributes

This aspect will be more fully dealt with in sections dealing with the simple entities philosophy.



 # causality and attributes
The blue arrows represent the path of a particle, moving along to the causal influences (the red arrow) it encounters.

Some of these causal influences are part of contracts between it and other particles, that establish its natural behaviour. One example would be an electron engaging in the weak interaction to maintain a sensible notion of an electron in an orbital shell, from falling into the nucleus.

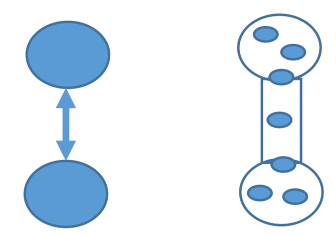
the green arrow is the causal influence of this change in behaviour, picked up by some measurement. This CS loop interaction of the blue particle with us ought to tell us about the red arrow, the contracts that lie beneath the

aspects of symmetrising flow
Symmetrising flows are simple, they are contractual relations between entities which structure the motions of entities. But, they may be thought of in many ways

0. What is causality? Causality is a change to invariable succession[1]. A cs loop can be thought of as a loop of charge within a field, which if it returns to its entity leaves its entity (and any other entity) unchanged.

However, if absorbed both entities will alter in nature. Fields then are an emission of causal influence which (potentially) alters both parties.

What is a contract? A set (or sequence) of causal changes, which alter our entities in a manner which leaves them invariant.



upper quasi-particle, new contract being formed by present particles

lower quasi-particle, unbinding of a current contract

There are two types of contracts: prior contracts which have formed our present particles, and new contracts which combine our present particles into new entities. Symmetrising flows can thus be of two types.

As our present forces exist to maintain our present particles, symmetrising flow usually remains stable. It could change if contracts are formed, but this is not the ambit of classical mechanics or thermodynamics. Structure formation is dealt with separately

new contracts and structure formation

2. Moving from particles to larger entities, symmetrising flow is the construction of contracts, with another entity or an abstract entity, which preserve the ffe nature of our entities.

3. the construction of contracts which condition the motion of entities. An example would be the creation of a gravitational potential with respect to an entity, created by its gravitational relations with other entities.

4. creation of new entities, a new type of thing, not merely a mixture of two old entities. This is the heartbeat of quantum mechanics.

5. the formation of bound objects, a collection of entities which can be counted as one thing, and which interact with us in some uniform and predictable (regular) manner.

[1] causality is more than this, but for present purposes this will suffice

why do we have forces?
We may regard our present particles as bound objects created by the symmetrisation of prior entities under prior physics.

Our present forces, are regular behaviours which arose to maintain these bound objects and consequently preserve their discrete quantum numbers.

3. HB loops
non-causal contractual motion; they act as potentials

A. a new contractual relation between present particles that structures their motion

B. a CS loop, of a present particle, where nothing happens

C. a fixed or static CS loop formed by past entities

CS loops construct HB loops, which form when these loops remain fixed and non-causal in nature. The change in manner shifts CS loops to HB loops and vice versa.

Forces exist to preserve HB loops. In quantum mechanics gauge theories preserve the quantum numbers of particles and maintain the charges and intrinsic masses of particles in their motions.

In special relativity, the privlieged frames are inertial co-ordinate systems which preserve the inertia of bodies. Inertia represents the energy required to move entities comprised of delocalised HB loops. Preservation of inertia consequently is preservation of the nature of our entities and as our entities will be stable in these frames this allows us to tell good causal stories about them and the changes to them.

differencing flow (D)

Differencing flows alter our C aspect, without changing our CS aspects. They deal with causal **transfers** of energy between entities and not causal **exchanges** of energies between them.

symmetrising flow (S)
The amount of energy within causal exchanges of energies in a contract between entities is symmetrising flow.

If forces preserve past contracts, then the influence of past symmetrising flows on present differencing flows will be slight. But, what about current contracts?

differencing flows, causal alterations in motions without the attributes of an entity changing

1. classical mechanics, example: the motion of a ball (with fixed hb properties) along a surface interacting with other balls

2. thermodynamics, the motions of a collection of entities e.g. gas molecules (with their properties determined by their hb loops) localised to a common stationary state[1].

[1] the bounding container, whic comprises the cs contract for the molecule

tendency flow
Interactions which alter the c-aspects of a set of bound objects.

Each bound object can tend towards either of two stationary states:
1. CT flow: they have separated from one another, and consequently have no causal influence on each other that would alter their c-aspect path
2. HT flow: they have come together to form a new bound object. Here, although their path changes from our perspective, they are in some sense in an equilbrium state for them. They are free of changes which would alter this path.

Tendency flows arise due to the presence of forces.

Differencing flows have two different tendencies because particles dont care how they remain bound objects. Only, that they do. So, our differencing energy can contribute to the formation of a contract that binds our entities together, or which by its unbinding leaves them separated far apart from one another.

In general relativity, we take HB loops to comprise space: a non-causal alteration in nature of the background upon which we move. We take entities to be completely bound, interacting with each other not with causal flows but with non-causal, co-determined structuring HB loops. These consequently, gravitationally, alters local inertial frames. And these changes alter the nature of the HB loops that comprise our entities.

4. mediocrity
the relationship between cs and hb loops

the principle of mediocrity
A bound object while it consists of entities interacts with the world with its own uniform causal nature. Now imagine, an entity (the 'joining entity') becoming part of this bound object. Prior to joining it travelled along its own c-path with its own attributes, but upon joining its nature changes. It interacts with the world mediocrely in a manner determined by the nature of the bound object within which it resides.

what kinds of paths are mediocre paths?
If our bound object is to remain a bound objects, mediocre paths must preserve the attributes of the bound object and consequently they must be non-causal in nature. They can influence other entities upon their motions but they cannot experience a net exchange of energy. The joining entitity to preserve the nature of the bound object, must now also act in the common manner: it must joint the HB loop of the bound object.

the same heartbeats

measurement
A measurement is an extensive sum of intensive units: it counts things that are the same, like the number of coins in a stack of coins. **Localisation is measurement**, as it harmonises the joining entity into the hb loop of our bound object. This hb loop is uniform in nature and functions as an intensive variable and it seems sensible to regard changes in our measurement of the property of our hb loop as coming from the joining entity.

HB loops are also a good thing to measure, as they preserve what is measured. This makes them the right kind of things to measure to know about our entities. It also means that changes to them must tell us about the joining entity. This measurement is also stable as the manner of localisation does not effect our properties.

paradox of measurement
The above (broad) description of the process of measurement leads to the paradox of measurement in quantum mechanics: the measurement and evolution of our wavefunction are separate processes.

This occurs because our causal worldline is a construct which implies:
1. **evolution is free**: our particles are not constrained to move upon our causal worldline, but that our causal worldline is a construct from their motions.
2. but, **measurement is upon**: this limits our ability to fully know these particles. We can only know their properties by measuring the change in nature of a measuring entity **upon** our constructed causal worldline, due to the interactions of the particle with the measuring entity.

As localisation is measurement, an entity being measured moving along its c-path must be held within the HB-loop of the measuring entity. But as our causal worldline is a construct we are only entitled to our evaluation[1] of some aspect of the HB-loop of the measuring entity not to the particles or paths that have delivered this measurement to us. We cannot a priori distinguish between particles that delivers this change in nature to the h-aspect of the measuring entity.

Consequently upon measurement, though we may know one aspect of our particle, other complementary properties exist now not as a defined value but as a set of possible values. This is the heartbeat behind the uncertainty principle: we cannot fully capture the c aspect of the joining entity.

[1] better, and more precisely, we are only entitled to the change in evaluation of this aspect

gravity
We interact with the active gravitational mass of an entity in a mediocre manner. We are indifferent to what composes the entity, but care about the total mass-energy of the entity. When energy enters a bound object, where does it go?

It's stored as intrinsic mass, and I believe that this mass-energy is stored in HB loops. The mass-energy within these loops alters space-time and by their nature without any further causal interaction with the entities passing through[1].

[1] general relativity contains quantum mechanics but with the presumption of existence (as energy) without exchange: while quantum fields CS loops exist they do not interact with entities.

quantum field theory
The same heartbeat applies to the absorption of a photon by an electron. The photon's c-path is erased, and there is an alteration in the hb group of the electron. For an electron alters the rotation of its hb group and we say that it experiences a change in its spin. Our photon now travels within this hb group till it is released along a new cs path, determined by the electron it resides within.

the smallness of localisation
the nature of localisation does not seem to matter much

We don't have direct access to the h-sector of entities, but at the energy scales at which we operate the detailed nature of the localisation of particles to bound objects does not seem to matter much.[1] So too, our physical theories hold good without a detailed knowledge of the localisation of our entities.

[1] A similar situation applies in thermodynamics. At the macroscocpic scales relevant to our everyday experience we can reason well enough using higher-order principles like "degrees of freedom", "ergodicity". The higher level physics bundles up into our theoretical thermodynamic entities well enough for the detailed physics to be ignorable.

Our present forces[1] preserve our past prior physics contracts. This effectively shields us from past prior physics flows and entities. We do not need to know them precisely as they hardly alter, and not in any manner discernable by our fields upon localisation. This implies two related things:

1. **preservation** Our higher physics created HB loops will be preserved by our present forces and interactions. Specifically, the HB loops that joining entities enter and which determine the nature of our bound object, the ones that need to not interact causally with us to maintain the stable properties of our bound objects, are loops that our present forces and relations preserve.

2. **change** We can work with quantum descriptions of stationary states corresponding to discrete changes to our h-aspect. For each discrete change, our fields alter in the same manner for all localisations. They will be fully determined by the higher physics relations between the infalling particles, and these relations will be preserved.

causality and mediocrity
Does mediocrity break causality? Is there a rupture in motion? Is unitarity preserved?

In the above descriptions of quantum fields and gravity, it appears that causality is violated : there are discrete jumps in the nature of our entity; its properties are erased and later it emerges with new ones.

It is my belief, that though we may not directly observe it to be, causality is preserved.

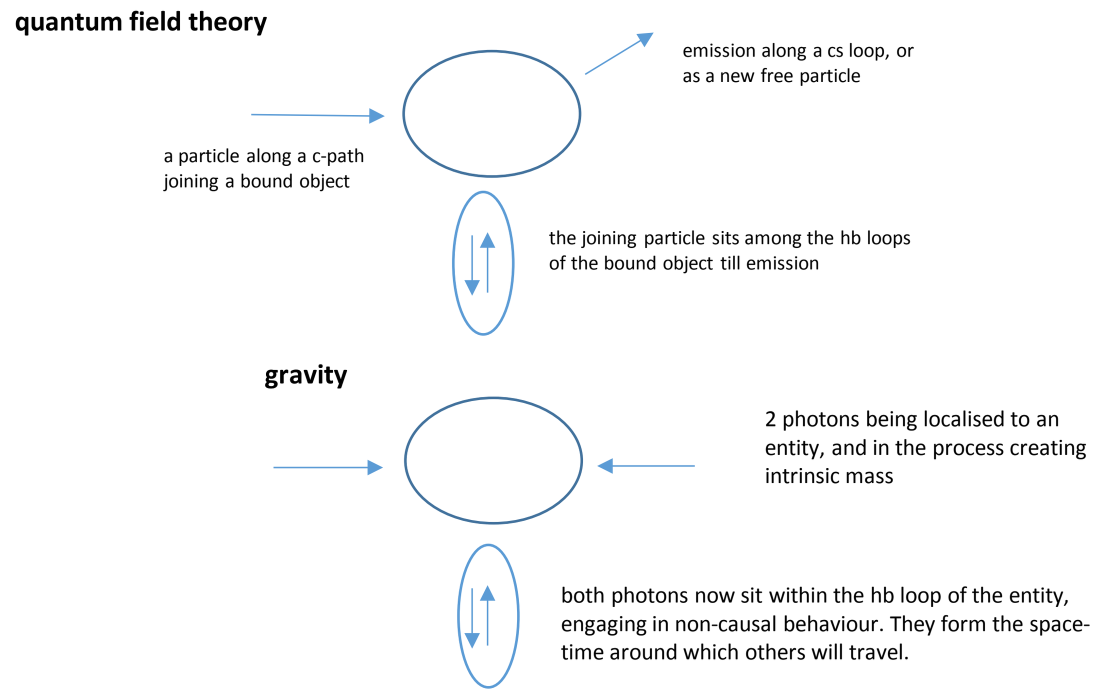
We can examine the behaviour of the joining entity from two perspectives. One, as a particle moving along some causal path upon our causal worldline. Two, as an entity freely moving along an equilibrium path in response to forces it experiences.

While motion from the first perspective might violate causality, motion from the perspective of the second does not. The problem is our lack of access to the higher energy physics entities and forces that determine the motion of the joining entity. And we are shielded from such by our present forces, which preserve the past contracts which create the bound objects that we regard as particles and with which we interact.

This is what I believe occurs. When joining a bound object, the causal entity has it's causal arrow shortened and it's h-aspect becomes more prominent in precise unitarity preserving interactions. Then as there is no barrier between its c-aspect and its h-aspect I believe that there is a switch in causal arrow from inside to outside and the joining entity now moves, causally in a manner determined by the common h-aspect, with its own c-aspect internalised.

Think of a ball rolling along a floor with bobbles back and forth along the way. As it interacts with the floor it might come to a stop, its causal arrow shortened by interactions with its environment. It will still be bobbling about though, and we might consider the direction of its present most prominent motion to be its new causal vector, with its past causal vector becoming internalised as a bobble of the new bound object with its new causal vector. Nothing has happened in this description which breaks causality in physics, *though we have no good description of the physics of the interactions of the particles of the ball with the particles of the floor*.

When falling into an HB loop the situation is similar to the above, but differs in this respect: apart from acquiring a new causal vector, there are non-trivial changes to the h-aspect of the joining entity. It forms a contract with all present particles and this structures its motions and the changes to its causal path completely. As the causal motion of the joining entity is completely determined by the present particles in the HB loop it cannot engage in any net exchange of energy with external particles. Consequently the properties of this loop determines the properties of the bound object that the entity has joined, and the changes to this loop represents the nature of this particle.



h-aspect properties

Indeed, we only seem to use five aspects of our localisation to describe our basic entities:
0. **mass**, the energy cost to moving more delocalised h-aspects

1a. **spin**, the rotation of our h-aspect
1n. **color**, the three dimensional rotation of our h-aspect

2. the weak sector

2a. **weak isospin** - rotates the entities that comprise our cs loops into the entities that comprise our hb loops and vice versa.

No essential barrier exists between the cs and hb loops of an entity; they form one unified whole. Weak isospin rotates particles 'inside-out' to preserve quarks and leptons as distinct entities

2b. **weak flavor oscillations** compliment weak isosopin

Our particles do not glide along a smooth floor but by their nature and by their relations construct a causal worldline peopled by stable particles. What is the relation between this constructed worldline and our primary quantum fields. Where does a particle travelling along lets say the QED field lie in relation to the constructed worldline with which we daily interact? Evidence suggests that both our constructed worldline and our particles are a mixture of motions within both primary quantum fields.

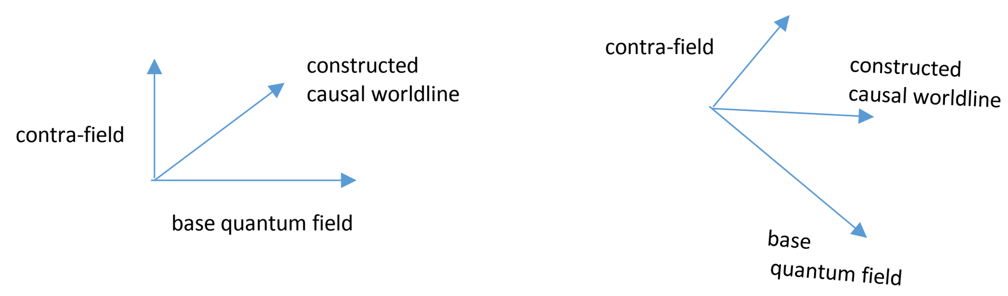
Consequently we cant regard the loops within our particle as sitting completely within the base field to which their containing particle is localised. Rather, they sit at different angles between these fields oscillating between these angles to preserve
1. the motion of the particle along the constructed causal worldline
2. the stability of the properties of the particles, by which we mean the nature of their loops when localised to this worldline in measurements.

The purpose of the oscillations is to construct a causal worldline peopled by stable particles. Each loop oscillates amongst three states to maintain their motion along our constructed causal worldline in a manner that preserves their nature, their cs-loops and hb-loops as localised to their particle.

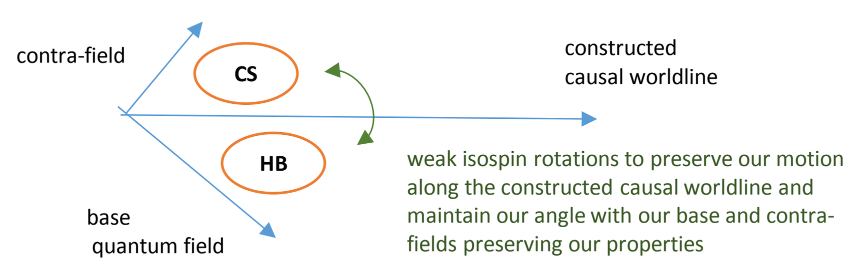
Must both our hb loops and cs loops sit at the same particular angle relative to our base c-aspect? The answer seems to be no. The hb angle can be described using three mass eigenbase states and the cs angle by three flavor eigenbase states.

2c. **cp violations**: In both the lepton (neutrinos) and quark sectors a general 18 dimensional unitary matrix relates the mass and flavor eigenbases.

But, with three flavors after accounting for unitarity(9), flavors (5), and rotation degrees of freedom (3) a complex phase angle is still required to describe this matrix and consequently we experience weak CP violations. However, this complex phase angle is appropriate as we *are* rotating between our insides (hb loops) and our outsides (cs-loops) in weak isosopin interactions. To preserve T we may consider adding in an O discrete quantum number leading to a COPT theorem, or modify our understanding of time reversal within internal loops in feynman diagrams.



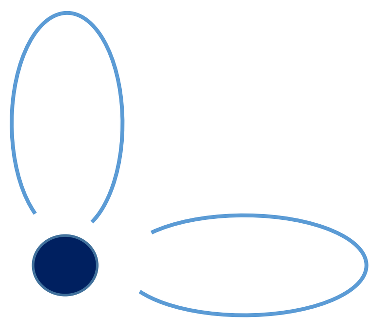
While our usual view of oscillation might be of an angle from the base field, it might be better to view this from the perspective of the constructed causal worldline, with our quantum field being at an angle from it.



5.a The simple entities thesis

The equivalence principle as an epistemological principle

attribute loop
A HB loop, or a CS loop where no causal exchanges occurs is where we store our nature.



observation loop
A CS loop where no causal exchanges occur except briefly upon observation and release is how we examine our entities.

The equivalence of these two loops means that the nature of entities, all that they can be, is precisely what we we (might potentially[1]) observe ourselves to be.

This leads to a subtle shift: all that an entity can be is all that we can potentially observe an entity to be. Observation may take precedence over the existence and nature of our objects.

Consequently we may write our encounters with entities, as a sum of offseting influences. → + ← , as frankly loops of behaviour whose net causal result is the motions we observe

The net effect is the energy change, or change in nature of an entity. But, the zero or null effect is special. It is the intrinsic attributes of the entity.

In the case of special relativity, we take our observation loop to be comprised of a pair of

[1] observation need not be perfect of course

motions where the doppler shift is noticeable. There is a consequent change in energy content of the body from E = 2h.f to hf'+hf'' as our experienced frequency alternately blue and red shifts.

This energy shift can be decomposed into a motion energy change (kinetic energy portion) and an intrinsic factor (a mass change).

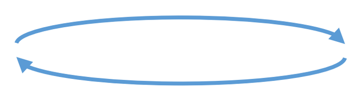
We can explain our bodies by their motions and their attributes, by changes to CS loops (we call these accellerative changes in this context) and to HB loops (attributes, here the attribute of intrinsic mass).

But, this method of reasoning is far from alone in the history of physics. Consider thermodynamics.

Here a null pair is decomposed into a loop over time within some bag. This turns this encounter once again into a potentially encounterable null loop. The net effect is the kinetic energy of the bag. The null effect is the temperature of the bag[1].

[1] consequently relativist temperature is simply the replacement of mass with intrinsic mass

the equivalence principle
as epistemological principle



1. hb loop
2. encounter with entity upon hb loop
3. splitting an hb loop into cs loops

A loop of light which we may consider in three ways

1. as a **constant hb loop**, which delivers to us the constancy of the motion of light. These constitute the properties of our entities, and they must in some sense be stable. if we measure the path of light over them we will discover light to be moving at a constant speed over them.

2. **as something which may be encountered** at each connecting point. If something happens at one connecting point, light from that event can proceed along an hb path until it is encountered by us. Consequently it **causally connects events**. This in combination with the constancy of light over the HB path leads to special relativity.

3. as something which may be split into portions which we may **qualitatively externally individuate**. Due to our external individuation[1] of travel upon the loops we **experience** the null hb loop in a causal manner upon our worldline.

We can decompose this behaviour into two effects. One, is independent of the worldline from which we perceive and the other is worldline dependent. The first is the internal attributes of the entity, the second we take to be a mechanics effect dependent on the internal attribute and by the difference in our worldlines, our relative motion to the entity.

[1] upon our worldline, or from the perspective of the common causal worldline

the simple entities thesis
the 3 steps

0. We conceive of an attribute as a potential. Changes to this potential has a detectable mechanical consequence.

1. We take this attribute to be comprised of a pair of motions are offset: there is no net effect upon us.

2. In some manner we can encounter these paired motions individually in a manner that leads to a non-trivial effect.

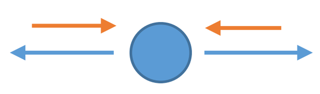
3. this analysis is done for every possible worldline, and is decomposed into two parts. The first is due to the relative nature of our motions and we take this to be the mechanical portion of the attribute. The other is independent of viewpoint and will be seen to be the same upon every worldline. The motion within is a true null loop, an hb loop, and it captures the intrinsic nature of this attribute.

the simple entities thesis: All that we may perceive comes about in the above manner. All physical phenomena can be explained with reference to the mechanics of our field and the intrinsic attributes of our entities

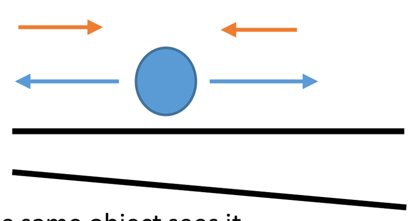
the localisation thesis: intrinsic attributes are solely due to the lack of localisation of some ur-fluid to our worldline. The geometry, topology and dimensionality of this space constrain our containers (and their possible intrinsic symmetric motions) modifying our encounters with this ur-fluid.

In the example of thermodynamics, if we increase the volume of a container, at constant pressure and particle number, then our experienced temperature will go up. There is more intrinsic energy available in our container and it is delivered over the same number of particles.

Equivalence Principle
(H in terms of C)



A bound object in mass balance upon a constant velocity worldline. It regularly shooots off a pair of photons in opposing directions (blue arrows),
and at the same time receives a pair of incoming photons (orange arrows), which leaves it's energy and momentum



worldline B
observing the same object sees it

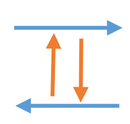
When viewed from another worldline, our object acquires a kinetic energy, and our pairs of photons become doppler shifted.

Evaluating the change in energy from the doppler shift we notice two terms.

One corresponds to our known change in kinetic energy.

The other corresponds to a loss of an intrinsic mass.

This manner of speaking may be extended to super-symmetry. Consequently to the question," Where are super-partners?" I answer they are in the same place we discover intrinsic mass: in the hb loops of our particles. They are particles of attribution, not encounter at the energy scales at which we operate.



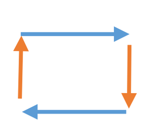
An alternate perspective

We have an internal H-aspect, the orange arrows, which contractually constrain the motion of photons in our entity, the blue arrows.

We can think of these as continuously being emitted and absorbed, or continually being transformed into each other, so that they are always in opposition.

When released, we have the argument of the prior section applying.

Taking the limit of worldlines towards our own, we reduce and reduce the net sum of our c-aspects. When, upon our worldline they are nulled, what we are



Evaluating this sum, in the limit and presuming our blue arrows net off upon our worldline, yields a value for our h-aspect. And crucially this h-aspect value is in terms of a sum of c-aspect motions.

String theory extends the principles behind general relativity and quantum mechanics from a simple entities thesis to a localisation thesis.

attributes are physical
The elimination of the classical vaccuum combined with the notion of a field leads naturally to a notion of HB loops. These are loops which return to our entity without interacting with the external environment in a manner that leads to a net transfer of energy. There is no classical vaccuum to impede or alter their motions.

For me, these loops and their properties when localised to our worldline, correspond to all the possible properties of a particle. Attributes are physical in nature. And, a particle is the bound object which is the sum of these attributes.

why and how do we experience these attributes?
We experience attributes because there are two perspectives in play here. One, the perspective of our particle. For it, the members of its field follow everywhere identical hb loops.

But, there is another perspective at play here. That, of our common, causal worldline. From it's perspective there are different causal outcomes to encountering a particle at different positions on an hb loop. This is the cs aspect of the loop.

The physical attribtues of a particle are determined by our causal encounters with the members of its field.

how do we determine these attributes?
the simple entities thesis

1. we can come to know the internal attributes of particles by our external encounters with them.
2. these are the only properties a particles may have.

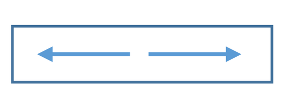
We can come to know our hb loops by our cs encounters.

the localisation thesis
properties are a topological endeavor

Properties are determined by our external individuation of hb loops. What about particles themselves?

Let's presume there's some common ur-fluid, but we may only encounter it in 'containers' localised to our common, causal worldline. The dimensions, geometry and topology of these containers govern

one line thermodynamics

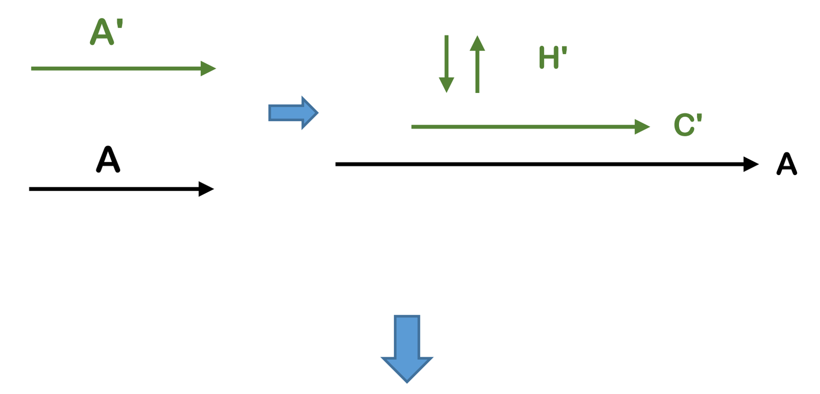


Take our container to comprise one groove filled with a pair of particles that oscillate back and forth encountering the edges of their container and then bouncing back. From the perspectiv of the container, its properties at all times remain the same, and so too from is perspective are the paths and nature of the particles constant. They are in equilibrium.

But, we may externally individuate collisions with these two particles, by the notion of volume (which separates collisions in space) and the notion of the number of 'atoms' present and arrive at the notions of pressure and temperature.

The same precise philosophy works when understanding mass-energy equivalence, though in this case the mechanism of external individuation is the relativistic doppler shift.

6. bound objects, clocks and rulers

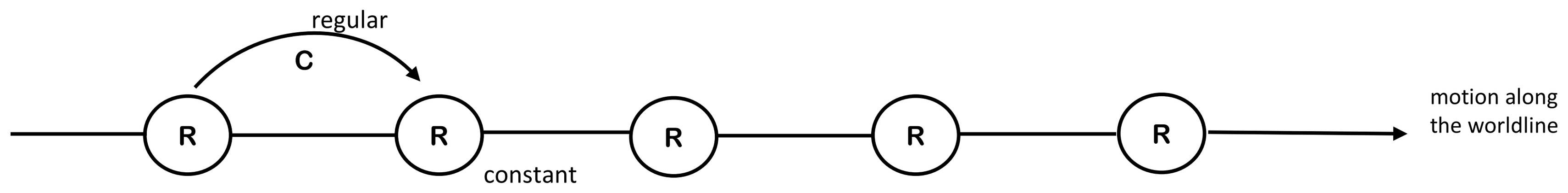


Each particle has two aspects, created by its relation to our common worldline. We call these it's c aspect and its h aspect.

Its c-aspect is its motion along our worldline and represents its causal arrow

Its h aspect determines its characteristics

These must sum to its worldline A'
A' = C' + H' (when measured from A's perspective)



special relativity rests on three sets of assumptions
I. the existence of clocks and rulers
II. newton frames which preserve inertia, clocks and rulers
III. localisation, the constant propagation of unbound light and the concept of a newton medium

I. the decomposition of bound objects into clock aspects and rulers aspects

The ruler aspect of a bound object is its constant aspect.
The clock aspect of a bound object is its regular aspect, this changes but undergoes a (hopefully, usable) periodicity.

We can imagine it as a literal ruler moving along a worldline, with a clock pulse ball being thrown out at one tick and returning at another tick only to be thrown out again.

We can get a better sense of these two aspects if we decompose our bound objects into two sets of motions.

1. cs loops
2. hb loops

A causal change to a bound object is a change to its invariable successions, a shift in its endless repetitions. Consequently, it is the change in clockness that indicates causal shifts.

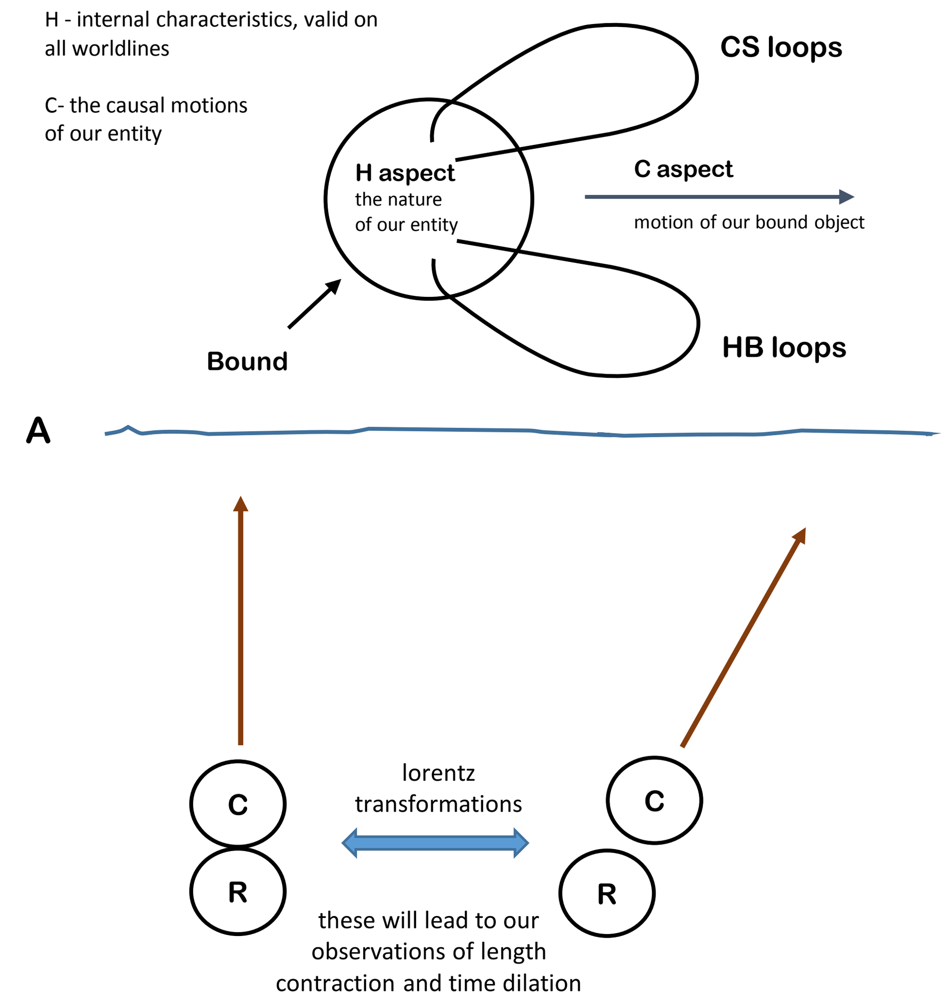
CS loops are causal in nature as:
1. absenting interactions, an entity will return to its bound object returning it to its prior state and consequently perform the role of a clock
2. but, while it us upon a cs loops it can engage in netr transfers of energy which alter the state of the bound object

When a comprising entity is on a hb loop, its motion is non-causal in nature. It can interact with other entities but it cannot engage in a net transfer of energy and momentum with them, and consequently the bound object maintains a constant character. [1]

[1] a hb loop functions more like a tape measure than a standard ruler, but the conception is adequate to our needs

We can recognise a clock by the emission of a light signal when an entity departs on a cs loop. We can recognise a ruler by its shadow. if we were to imagine a light sitting just behind the ruler, then the ruler aspect of an entity will lead to a defined shadow, upon its worldline (or better a deformation of our light signal in a recognisable way).

We obtain special relativity by evaluating the relationship between clocks and rulers upon different worldlines.



This conceptions of clocks and rulers, doesnt capture everything about the objects we encounter. But, they do show that they capture some of the essential nature of entities. So, alterations to this nature matter.
And the idea of a bound object, indicates how the transmission of signals matter for the maintenance, and creation of complex entities.

Special Relativity is linked to causality by more than the accurate mapping of events.

minkowski metric and the switch to a relative conception of space

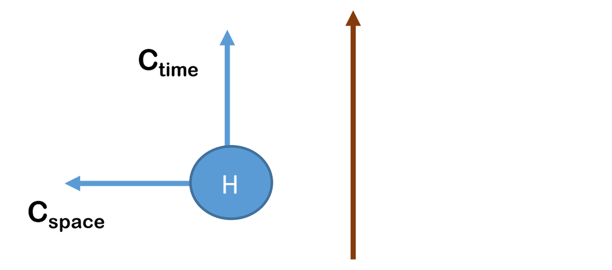
Given our three constraints, in combination with standard arguments for two worldines travelling at differing velocities to one another, we obtain the lorentz transformations. But, beneath special relativity is a switch in conception of space-time istself.

Given an entity perceived as a particle
it seems it can have only one of two aspects:

1. it can move through time along the direction of motion of its worldline, maintaining its relations with other (unchanging) entities upon the worldline

2. it can move within space, altering in position within its worldline, by moving in a direction orthogonal to the direction of motion of the worldline

To exist bound to our worldline, is to be measured to move in either of these two ways. How do different worldlines relate to each other? **They relate to each other, co-ordinated by light pulses, whose motion through space-time we can only access through geometric quantities associated with the Minkowski metric. We have given up the notion of the absolute motion of a worldline through a background space-time, and switched to a relative one co-ordinated by light signals.**



Worldline to which the measurements of the entity are localised

II. Newton frames
What motions maintain clocks and rulers?

A natural assumption is that clocks and rulers mantain their character during measurements: they remain bound objects.
What does it mean to be bound? I take it to be a certaint constant structuring of the motions of constituent entities that delivers a consistent common character. The relations between the entities within hb and cs loops remain the same.

This presumes the constancy of the h-aspect of entities. To be bound is to be part of a structure, which means to be free of any change to your present structure. There is no change in potential, or noticeable change in its structuring or h-aspect.

Consequently, the stability of clocks and rulers implies a frame where the laws of newtonian mechanics hold good, though the frame itself may be undergoing motions.

III. localisation, the constant propagation of unbound light and the concept of a newton medium

light:
1. has a constant speed in vaccuum
2. does not alter in frequency after emission

The combination of these two aspects allows light to function effectively as a mechanism of causal transmission. It clearly communicates the nature of entities to us, and causal changes to this nature.

why is the speed of light constant?
When light enters a clock or ruler, it is localised to an entity.
However, as causality is a construct, free of this localisation there is no causal medium or aether through which it wades and consequently no a priori alteration in its character.
The constancy of the speed of light directly leads to the Lorentz factor, and the notion of time dilation and length contraction.

inside loops match outside loops
Within a localisation, light maintains its character. It moves in the same manner and speed as externally but is continually influenced in its path. There is a continuity and consistency to the motion of light. Consequently it is conceivable that some outside measurement of the path of light could unravel a particular attribute associated with a loop of light within an entity.

light captures some of the causal nature of entities and transmits this without alteration to us
As a photon is localised to an entity and harmonised into an hb loop its frequency alters to capture characteristics of the absorbing body. Upon emission this frequency does not alter in transmission as the speed of light remains constant.
Consequently, travel between localisations preserves our ability to measure causality. The light we receive conveys the causal information of the emitting body and is not transformed by its path to us.[1]
This sort of a medium is a newton medium.

[1] we reverse this perspective to discover alterations in space-time itself working back from knowledge of the nature of a standard candle
[2] from principles implicit in newtons third law

the simple entities thesis (see B.2.2.1 equivalence principle; see C.1.1 the entitential thesis)

From the above two points we arrive at a new thesis. Changes in observation of loops of light emitted from a body and received by us, are not only our best way to measure, they are both

1. our only way to measure
2. they captures all attributes of an entity
There are three heartbeats to this thesis, but they all speak

In this particular case, it relates the manner in which we store our nature is the same manner in which we communicate and interact with others. The diagrams on the next page explain this more clearly.

The standard example refers to a pair of photons emitted from either side of an object, that capture the energy content of the object (E = 2hf, where f is the frequency of the emitted photons).

The only thing we can do to know about this object is to observe this emitted pair of photons, *in whatever frame we are in*. Doing so, we discover that the object has a particular kinetic energy with respect to our frame and it has additionally a value independent of our frame which we associate to the intrinsic mass of the object.

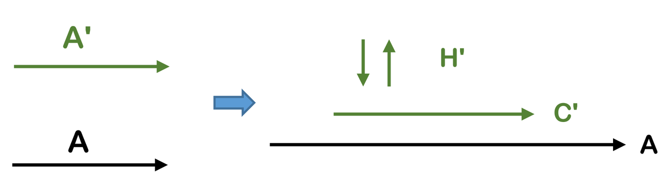
Consequently changes to an entity can be explained by either changes explained by mechanics or to changes explained by changes to its intrinsic mass.

We can understand an entity by its HB loops (attributes) or by its CS loops (motions). And these attributes are intrnsic to the entity, they are not observor dependent.

This is the heartbeat of special relativity, and in modified form generalrelativity.

We store our nature in loops of light and we speak to each other in loops of light, consequently what we are, we can say we are.

7. the relationship between bound objects



Each particle has two aspects, created by its relation to our common worldline. We call these it's c aspect and its h aspect.

Its c-aspect is its motion along our worldline and represents its causal arrow

Its h aspect determines its characteristics

These must sum to its worldline A'

C - causal behaviours
H - structures whose changes alter causal behaviours. Included in these are co-determined contracts which establish the essential nature of our entity.

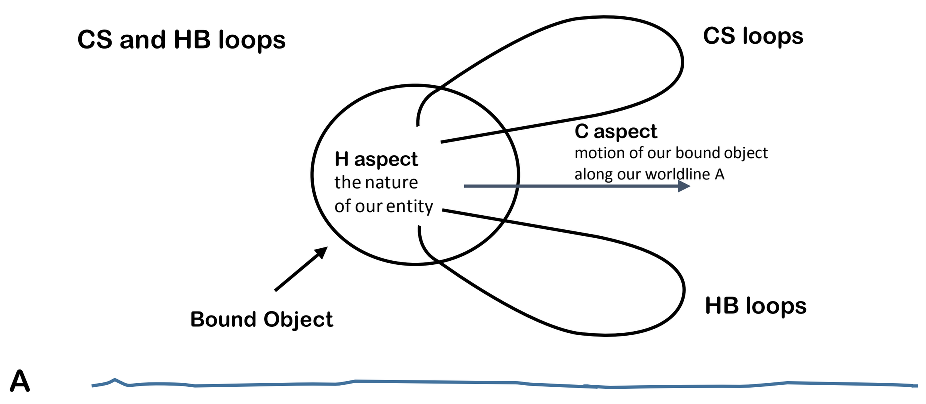
we can think of H as a sum of causal behaviours (either a pair, or a loop) which has a null value. Changes to this sum consequently alters our causal behaviours altering C.

The notion of inertial mass captures the inherent lack of localisation of our entities, the fact that they possess h-

this notion of an internal sector to a particle leads to concepts within

naturalness
super-symmetry
& string theory

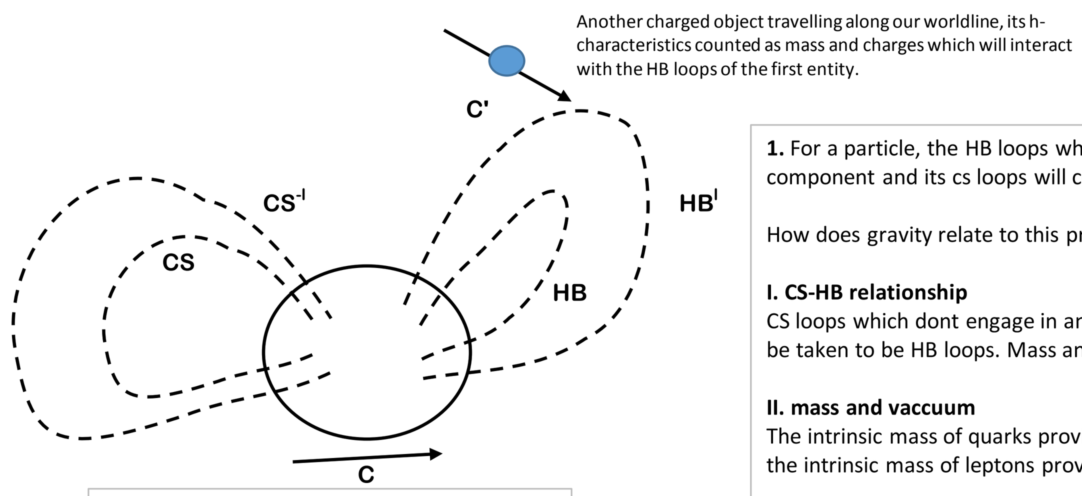
CS and HB loops



We can decompose the h aspect of our bound objects into two sets of flows
1. cs loops
2. hb loops

When a comprising entity is on a cs loops it can interact causally with other entities, and our bound object can engage in energy transfers withthem. There is a causal change to the entity, a change in state, Absenting interactions, an entity will return to its bound object returning it to its prior state.

When a comprising entity is on a hb loop, its motion is non-causal. it can interact with other entities but it cannot engage in a net transfer of energy and momentum with them.



H and C loops viewed in their field aspects internal HB loops curve space; internal CS loops engage in causal transfers

1. For a particle, the HB loops which comprise its mass will be its inertial mass component and its cs loops will comprise its gauge field.

How does gravity relate to this presentation?

I. CS-HB relationship
CS loops which dont engage in any net energy transfers to other bodies can be taken to be HB loops. Mass and energy both contribute to gravity.

II. mass and vaccuum
The intrinsic mass of quarks provides the quantum vaccuum for leptons;
the intrinsic mass of leptons provides the quantum vaccuum for quarks.

The gravitational vaccuum is the sum of these two quantum vaccuums. What we normally regard as gravity, is the net effect of both. **Gravity is what quantum fields do when they are not doing anything. There is a residual causal power to null energy exchange interactions.** At the heart of this approach is the relationship between smooth and discrete effects. The sum of the various discrete quantum vaccuum interactions can be equated with a smooth gravitational interaction with the local curvature of space[1]. The equivalence principle shows how we can break up an HB loop into CS loop components; here the reverse applies. CS loops can sum into an HB loop.

For large massive bound objects, with no (other) obvious causal influence on each other it seems sensible to simply refer directly to this composite, gravitational HB loop.

[1] This also applies within quantum field theory. Higher loop diagrams, without noticeable causal effect, can be summed into a smooth curvature of space.

This somewhat explains the weakness of gravity, it is a net effect of more powerful cs interactions. And it somewhat explains the difference between the gravitational vaccuum and the quantum vacccuum. Its an (acausal) HB vaccuum, so it doesn't seethe with particles. Instead its influence is smooth and comes through in a curvature to space. Tying the quantum vaccuum to mass and matter, also remedies the difference in energy profile of the two vaccuums, .

no gauged quanta
HB loops alter the local environment in space. Although they cannot directly transfer energy to entities, the amount of energy flowing through them, and the amount of net transactions that occur provide a notion of a curved space. But, without the necessity for a particular gauged quanta.

equivalence of passive and active gravitational mass
The more massive an entity, the more delocalised stuff on hb loops to interact with other entities. Hence, the equivalence of passive and active gravitational mass.

We can regard quantum mechanics as stories about particular interactions, interactions where energy is exchanged, and gravitational interactions as stories about the general, co-determined and unchanging[1] relationship between bound objects.

[1] objects follow their geodesics without particular interactions

There are six aspects to general relativity

The **first**, the relationship between matter, inertial matter and the gravitational curving of space has been dealt with above.

The **second**, is the issue of the co-determination of the metric and stress-energy-momentum tensor, and the non-linearity of the resulting equations.

The **third**, is the equivalence principle, the particular relation between our H and C sectors.

The **fourth**, the significance of inertia, inertial frames and second-order changes to them (in anticipation of a Newtonian limit).

The **fifth**, what are the objects within general relativity?

The sixth,

Why lorentzian manifolds
Thermodynamics is the physical theory of a lack of localisation. If I am not impacting you here, it is because I am impacting you there.
We are ignorant of precise paths, but a mixture of particles can create (can be localised to) a common, a causal object with regular behaviour.

In special relativity, the same philosophy applies. But, our vectors are bounded by an uppermost speed c and we can travel equally as well in space and in time.

What do tensors do?
Tensors conjoin vectors, and in that sense fit precisely within the simple entities philosophy.

5.) the existence of bound objects

1. **What are the entities within general relativity? They, are for me bound objects localised to our common, causal manifold** (consequently no quantum vaccuum remains, nor any motion that is not localised to our common, causal, gravitational manifold). Their causal aspect (their cs interactions; quantum aspect) have been switched off. While objects still possess CS loops they dont engage in causal transfers of energy and function as HB loops.

Our theory of General Relativity is then a theory of the average or acausal background upon which we discover causal interactions. Consequenty, the dynamics of general relativity are a non-trivial exercise intimately linked with quantum mechanics (which is why string theory sometimes provides such good results).

2. the fluid conception of matter
As forces preserve past contracts, we can take as the elements of our bound objects not our particles but the entities which compose our particles. These can shift around within our bound object in a manner which approximates a fluid conception of matter. We, are explicitly stating that gravity is the force that preserves our bound objects as bound objects, bound together by whatever higher-energy flows apply.

3. the stress energy momentum tensor
Lastly, we play close heed to the equivalence principle. this states that from every viewpoint, we can decompose an object and its attributes into little loops of energy flow. The stress-energy-momentum tensor is related to our conception of mass-energy equivalence but in a more complicated and realistic format. Each of the intrinsic attributes of the entity are represented by little hb loops joined together into a large fluid ball.

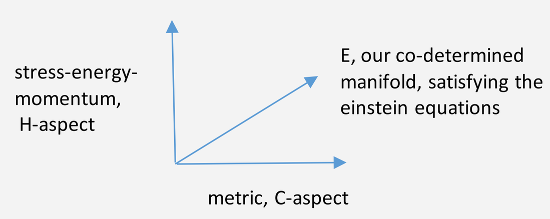
2.) Non-linearity, Co-determination

General Relativity represents the co-determined, contractual component to our physics. It can be regarded as determination of the base from which quantum mechanics which determines causal interactions operates.

Consequently, it's okay to have the stress-energy-momentum tensor and the metric co-determine each other. Stress-energy-momentum ***T*** and the metric ***g*** are co-determined! Space alters energy, and energy alters space.

The nature of the common, causal worldline is determined by the hb flows at that point. As hb flows change, the common, causal worldline will alter. Our HB loops are determined with respect to a common, causal worldline. As we move along our worldline they will alter. Our c-aspect will influence our h-aspect.

Parallel transport does a useful thing, it switches off the stress-energy-momentum tensor. If it is not present, then there is a necessary split, and one that can only be solved by co-determination.



4. Inertia and inertial frames
The constituents of our entities do not move upon our causal manifold, but are localised to some entity that does move upon it. Inertia measures this intrinsic lack of localisation, and tells us the energy cost we have to pay to move entities with more or less localisation. Inertial mass captures the delocalised nature of our hb loops.

Inertial frames respect the propagation of inertia, respecting the propagation of the motions in our HB loops which determine the intrinsic attributes of entities. If we are moving in a manner that preserves our hb loops, we are moving in a manner which preserves the essential nature of our particles, and these will be frames within which we can tell good causal stories. Alterations to inertia ought to lead to

4.) the relative conception of interaction
the covariant formulation of physical theories

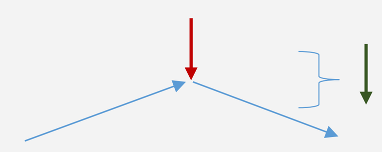
A relative version of Newtonian gravity, the Poisson formulation precedes General Relativity. In General Relativity we switch the manifold from riemannian to lorentzian respecting locally the Minkowski metric. This follows the principles of general covariance: we can only refer to space-time by quantities calculated from the geometry of our space-time manifold.

6.) Correspondence Principle
in some way the new theory must aggregate to deliver the experimental results of the old theory.

Our new theory contains within it phenomena not explained by the old. Things that were previously reconciled away, have now become explainable. But, we may reverse this perspective. Under the appropriate reconciling items, our old theory worked.

If we can go back to the same circumstances we ought to recover our old theory. Consequently by examining how our reconciling item has changed and become part of our new theory, we can change this component of our new theory to mimic the circumstances of the old. In this case our old theory ought to apply.

While, one this is a useful test as to the adequacy of a theory its also a useful method to calibrate our theories. In General Relativity we make use of Special Relativity as a limit theory, and Newtonian gravity as another limit.



 # causality and attributes
The blue arrows represent the path of a particle, moving along to the causal influences (the red arrow) it encounters.

Some of these causal influences are part of contracts between it and other particles, that establish its natural behaviour. One example would be an electron engaging in the weak interaction to maintain a sensible notion of an electron in an orbital shell, from falling into the nucleus.

the green arrow is the causal influence of this change in behaviour, picked up by some measurement. This CS loop interaction of the blue particle with us ought to tell us about the red arrow, the contracts that lie beneath the attributes it has.

The CS aspect will represent our metric, and the force aspect will be represented by changes to our stress-energy-momentum tensor.

We know from the Bianchi identities that grad (Ruv - R) equals 0, so it seems sensible to set, from the above diagram's relationship between g and T, a linear relation between Ruv - R and Tuv , with the specific form being $R_{uv} - R = 8\pi G.T_{uv}$.

3.) the equivalence principle (H-C relationship)
see B.2.2.1; C.1.1
There is an equivalence between changes to our H-aspect and changes to our C-aspect. Our H-aspect is our relations with other entities which which determines the structural constraints on our causal paths (our C-aspect). Changes to our relationship with other entities is exhibited as changes in our causal motions, and vice versa changes to our causal motions can be thought of as coming from changes to our relationship with other entities.

There are two aspects to the equivalence principle:

I. freedom. in the absence of a change in our H sector we will move freely in terms of (one of) our causal C motions. One example is newtons third law: an object at rest or undergoing uniform motion in a straight line will continue to do so unless acted upon by an outside force. In general relativity in the limit, as we decrease the size of our matter balls, the motion of matter does not depend on the stress–energy–momentum tensor $T\mu\nu$ but only on the geometry of the metric that defines geodesics. In this sense, the gravitational field has been switched off and all things fall in the same way.

II. expression. We write our H aspects as a null sum of causal motions in our C aspect. This is usually expressed by einsteins equivalence, that by a suitable sum of C's we may mimic the change in an H-aspect: by suitable accellerations we may mimic the effect of the force of gravity, which is a change in our gravitational potential.

That our H aspect which governs our forces, may be expressed as a sum of C aspect motions is the heartbeat behind the equivalence principle in general relativity

and the path integral in quantum mechanics

the differences in quantum mechanics are these:

1a. as we dont have access to an a priori causal manifold, we can place no causal restrictions on our paths others than those necessitated by our causal measurements. Multiple paths are thus available.

1b. on our path we may interact with the vacccuum, which is a sum of net zero energy exchange interactions.

2. as we are not constrained to an a priori causal manifold we have internal quantum numbers. These arise from our h-aspects, the decomposition of our ball of motions from point to point on the causal manifold.

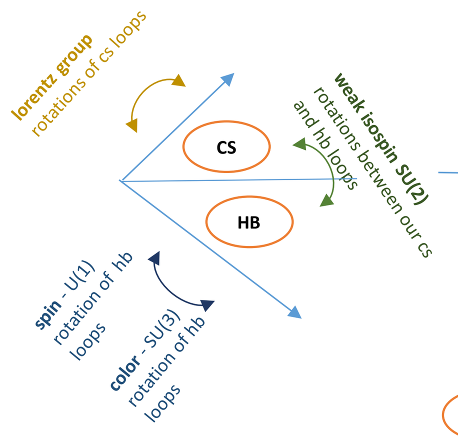
3. quantum mechanics is taken as the causal aspect of an underlying general relativity manifold co-determined by the bound objects upon it.
It alters things gravitationally fixed.

Consequently, the time aspect in qm and gr differ. Our curved space-time is given in

8. causal relations between particles

quantum mechanics and properties of the standard model

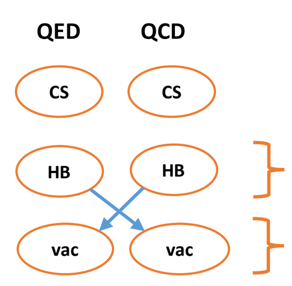
the standard model



constructed causal worldline

flavors to preserve our motion along the constructed causal worldline and maintain our angle with our base and contra-fields preserving our properties

cp violation
as our hb loops and cs loops have separate eigenbases. There are non-trivial cs-hb rotations that violate T.



Intrinsic Mass

qed_hb = intrinsic mass of qed particles
qed_hb = quantum vaccuum for qcd particles

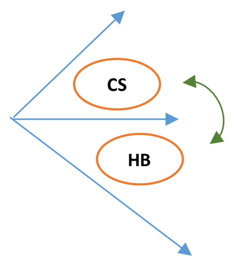
Vaccuum for QFT

qcd_hb = intrinsic mass of qcd particles
qcd_hb = quantum vaccuum for qed particles

QM and time

The HB aspects of bound objects from which our causal flow arises and sets down upon, creates the local external (curved) structure of spacetime and it creates the stable invariable successions that provides our notion of time.

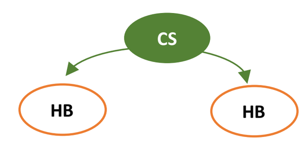
QM provides the causal shoves that alter their nature.



CS-HB switching
leads to the ideas behind dual gauge fields
leads to AdS-CFT duality upon the worldline
Conformal Field theory of cs loops matches the AdS theory of hb loops.

QM and branes

Each CS quantum loop exits from and is captured by an HB loop



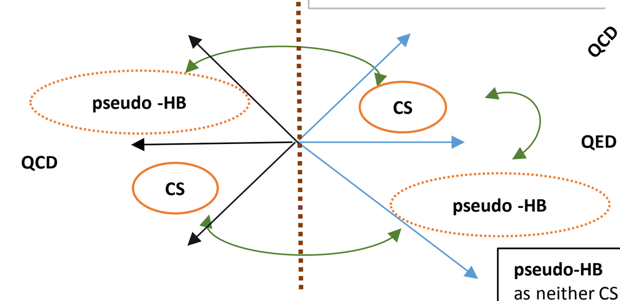
the oddity of neutrinos
Our standard presumption when working with a gauge field, is that by removing reconciling items we will eventually arrive at the true free motion of our entity, and its intrinsic properties. And this presumes that there are a pair of fields, with one controlling the starting and stopping of motions in the other.

However what if we cannot so neatly separate our entity; it sits intrinsically within both gauge fields? With respect to the qed and qcd quantum fields, this is the case for neutrinos.

They consist of a single pair of CS aspects split across two fields. Each aspect creates a pseudo-HB aspect for the other CS aspect. One consequence of this is that they present as both massless and have a tiny induced mass from oscillations between the CS and pseudo-HB sectors. Another is that a neutrino presents as massless as its gauge group splits. Lastly, because the particle must present as identical in both fields it cannot engage in causal interactions in both. Consequently its CS loops function as HB loops and it doesn't have either spin or color charge.

However, it should be able to interact via the weak force in this schema. And it does.

line of equilibrium between both fields
As the neutrino wishes to maintain its nature its CS loops cannot engage in causal transfers and consequently they must function as HB loops.



pseudo-HB
as neither CS loop sits completely within the qed or qcd fermion field , a pseudo-hb component emerges in the other field.

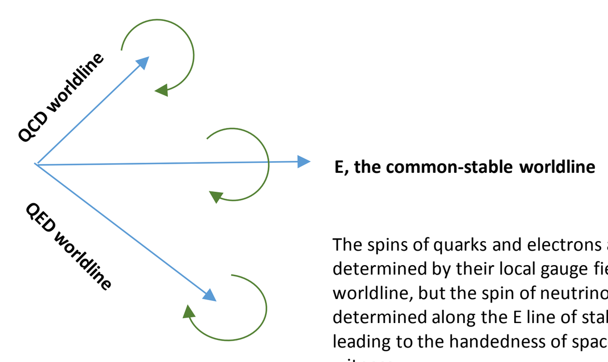
This is responsible for the tiny mass of the neutrino, and for its CP violations.

C,P violations
As neutrinos sits amid a pair of gauge theories we cannot associate an intrinsic spin to them in a normall matter. Along what axis in the base gauge field is it spinning?

Neither.

It is moving intrinsically with respect to the local combined qed-qcd field represented by the E line of stability. We can validly assign a parity to neutrinos, and consequently a notion of left and right handed to space because this E line naturally associates with the local momentum vector. **It is valid for their spin to be tied to the external motion vector**.

But as they must also obey the constraints on their group structure above, the CPT theorem and the necessity of a consistent spin in both qcd and qed the Standard Model representation of them is thrust upon us.



The spins of quarks and electrons are determined by their local gauge field worldline, but the spin of neutrinos is determined along the E line of stability, leading to the handedness of space that we witness.

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the string integral
topology and qft
we are as free as possible subject to our causal constraints

In a field theory process emissions and absorptions occur at precise space-time points, however if causality is a construct we cannot a priori determine the causal story that has occurred. We are only entitled to the (topological) shape of events but not to the particulars of what has occurred between causal measurements.

This is the heartbeat of the string integral and string theory. Only topologically distinct paths matter.

Given the above constraint, we place the behaviour of our particle in a common causal bag, whose regular behaviour we assess to determine causal constraints exist on the behaviour of our particle.

a thery of hb loops

In string theory we replace point particles with tiny strings which may be open or closed. These correspond to a theory of hb loops for the particles we have.

These strings may

1. vibrate and these vibrations correspond to different kinds of standard model particles. In addition string theory incorporates gravity as one excitation of a closed string is a massless particle of spin two, which has precisely the properties of a graviton in an active theory of gravity.

2. break in two and join together. All standard model interactions such as the famous qed tree diagram arise from this single basic string process.

There are five consistent (super) string theories, known as types I, IIA, IIB, heterotic SO(32), and heterotic E8 x E8. These differ primarily in the way that the supersymmetry acts on the states of the string;

where are the extra dimensions
the particle desert
Where is intrinsic mass? It is located in two places. Physically, within our H-sector as a loop of energy within our HB-aspect. Theoretically, it is a model element, an attribute of our entities, with which we try to consistently explain our world.

The same applies to super-string theory super-partners. It is naive to presume that our present forces will act to disturb these values at the energy scales relevant to particle physics, as these self-same forces were created to maintain our particles as particles, to maintain these entities as bound objects. Our present forces have come about to maintain our past contracts **(see C.1.2.2 forces).** Consequently, we should not easily expect to see new-physics particles till certain threshold temperatures are reached.

Encountering the world
New-physics theories create named objects we can use.
They create attributes for our ontities in a consistent manner.

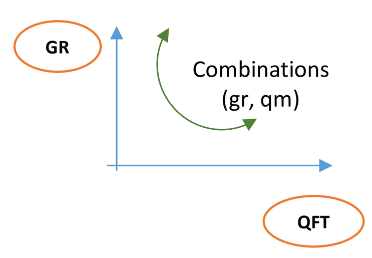
If I were to say that both super-symmetry and string theory apply to the world, what would I mean by this?

The naive approach: at a higher energy scale, we would discover elements of these theories (or elements of their combination) and they would perform a gauge reconciliation of phenomena in our world. We would remove all unneeded reconciling items (e.g. low energy approximations, observation, etc.)

But, the complexity of our constructed causal worldline and our access to both this worldline and the consistent particles upon it via deviations to bound objects make this approach difficult to fulfil, at temperatures conceivable to us.

Instead we might take our particles as being strung by these higher physics flows, creating a common object we can take to each of our theories. These are good things for three reasons:

1. We ourselves are indifferent to moving within GR or a QFT. Consequently we can take elements and findings in one theory, transform them as best we can into the new physics theory and see if we can talk about them or similar situations in the other theory. And this is not limited to simply these theories. We can take findings in one theory and constrain results in others.
2. The elements in our lower theories can only be "distinct" versions of the bound objects which can occur in the higher physics theories. This constrains what our particles can be. And it onlo shows haw thoy might relate one to the other.
3. Higher physics degrees of freedom correspond to the formation of attributes of our present particles. Like the determination of intrinsic masses for particles, these so formed attributes should be consistent in our encounters with the world.



String Theory
We can think of string theory models as dualising objects between situations where GR is rolled up into the bound objects of QFT, and vice versa where our QFT's are rolled up into the bound objects within GR.

It provides a way of consistently speaking about QFT and GR, each string model splitting into two different aspects which correspond to a QFT and a

In the confrontation of language with the world, the fact that we do not have one word precisely applying to one object and one word applying to each action does not constrain our use of language to explain the world in our encounters with it.

the localisation thesis

1. **(the hb principle)** Intrinsic attributes derive from HB loops

2. **(the isostasic ball principle)**

a. **(lack of localisation)** These intrinsic attributes are solely due to our lack of localisation of this HB loop to our common causal worldline.

b. **(external individuation)** particles travelling internally within the bag as they would externally upon some worldline.

3. **(the equivalence principle)** we can access these attributes by motions on our common causal worldline. We can write our h-aspect as a sum of causal c-aspect motions.

4. (**attributes are intrinsic**) In the decomposition of our h-aspect into causal c-aspect motions, there will be components whose value do not depend on the particular frame from which we are viewing our entity. These are the attributes of our entity and they are intrinsic (viewpoint independent) in character.

These attributes present themselves in a uniform manner, they are independent of the motion of individual worldlines moving upon the common causal worldline from which we view the entity with the attribute.

We can decompose physics into changes to the motions of entities or changes to the attributes of entities, into free C aspect motions and changes driven by changes to

what do all these extra dimensions do?
attributes and naming

The extra dimensions of string theory can have a complex topology and geometry. Although we do not see these dimensions directly, their shape determines the physics that we do see—the spectrum of particles, and their masses and couplings.

These dimensions constrain the containers our hb loops can reside in. And these containers are filled with higher physics entities which have formed bound objects and forces between them to prevent changes to their nature. Higher energy physics lies locked up within[1]. And what we witness below are attributes determined by the topology and geometry of these higher physics dimensions.

[1] This is why the proton has never decayed. Our present forces prevent them from ever doing so. This is why these forces arose: to preserve higher physics bound objects.

degrees of freedom and observables

a degree of freedom is a state which equals an observable and vice versa an observable is a state which equals a degree of freedom

Better: anything we can observe on our worldline corresponds to some number of degrees of freedom in the higher theory.

The degrees of freedom in the higher theory must sum to the things we witness in the lower theory. And their character must in some sense be related to their number of degrees of freedom.

These dimensions form the basis for us to name things,
and then for us to consistently use these named things and their properties to tell causal stories about our universe