Unify Truth

- Physics Is Equivalent to Science of Perfect Pursuit

Abstract: In this paper, "science of pursuit" is established by generalizing action pursuit in the Universe, happiness pursuit in society and knowledge pursuit in research. The theory is partially axiomatized and proved to be equivalent to Quantum Electrodynamics. Universe expansion and curved space-time become inevitable results of pursuit: development. Foundation of the Universe is two two-dimensional complex resources mapping together.

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1. Introduction

The Universe pursues largest negative action; society pursues largest happiness; economy pursues largest profit; research system pursues largest knowledge. So sciences about largest negative action pursuit, largest happiness pursuit, largest profit pursuit and largest knowledge pursuit can be unified into one: Science of Pursuit. Science of pursuit tries to unify sciences to simplify truth the most, avoiding infinite truth in infinite sciences.

The theory will be explained in four parts, sections 2-5: definitions; axioms; proving perfect pursuit will lead to system expansion and curved space-time; cosmology.

2. Definitions and explanations

Pursued quantity (-S): When a system tries to make one quantity the largest, the quantity is called pursued quantity. It is a real number.

The system is called a "pursuit system". In the universe, the pursued quantity is negative action. Whole physics can be deduced from largest negative action principle, which is equivalent to least action principle. In physics, particle's action is defined to be negative, not a very good definition.

Perfect pursuit system: Perfect pursuit system is a system that really makes pursued quantity larger than any other possible systems. Science of Perfect Pursuit studies all perfect pursuit systems. If the Universe pursues negative action perfectly, physics will behave the same as Science of Perfect Pursuit.

Methodology: methodology guides pursuit, deciding pursuit efficiency and development speed. A pure pursuit system is decided by methodology and feelings.

Basic natural laws are perfect pursuit methods. Their advantages can be tested in any pursuit system. They are followed in the Universe, but not totally followed in society, so society does not pursue the best.

Feeling: feeling is the mathematical expression of pursued quantity. It is the function of the resources in a pursuit system, which can be classified into abundant resources and scarce resources.

In a close pursuit system, there are only feelings and methodology.

Occupying: The scarce resources in a pursuit system are called occupying.

Occupied: The abundant resources in a pursuit system are called occupied.

Occupying is the quantity representing a pursuer's desire and pursuit ability. It has two forms: symmetrical occupying (m) and anti-symmetrical occupying (q). Symmetric occupying corresponds to mass in the Universe and desire in society. Anti-symmetric occupying corresponds to charge in the universe and sensitivity for price change in economy.

Occupying chooses from all possible occupied, and also produces occupied.

Occupied also has two forms: symmetrical occupied (ds, dx_i) and anti-symmetrical occupied (A_i). Symmetrical occupied corresponds to space-time distance in the universe and commodity in economy. Anti-symmetrical occupied corresponds to electromagnetic field in the Universe and price in economy.

In fact, symmetrical occupying is the pursued quantity from unit symmetrical occupied. All symmetrical occupying has the same sign. It is accumulative, representing the accumulation of pursuit results. Anti-symmetrical occupying is the pursued quantity from unit anti-symmetrical occupied. It can be both positive and negative for the same anti-symmetrical occupied. It corresponds to charge in the universe and sensitivity for price change in economy.

The main difference between occupying and occupied is: occupying is always realized (occupying some occupied), while occupied are just possible to be occupied (most occupied are not occupied).

Pursuer: the smallest unit of a pursuit system that pursues independently.

The scarce resources have small probability to meet each other, so they are normally mutually independent. Therefore, occupying is normally independent, i.e., pursuers seldom exchange occupying.

Competition and reciprocation: when two pursuers' anti-symmetrical occupying has the same sign, they are called "competitive pursuers". When two pursuers' anti-symmetrical occupying has opposite sign, they are called "reciprocal pursuers". And their relations are called "competition" and "reciprocation" respectively.

Development: success of pursuit will lead to the growth of symmetrical occupying and symmetrical occupied. The growth of symmetrical occupied means larger system scale, called system expansion. It corresponds to expansion in the Universe, development in society and knowledge progress in research.

Development degree: pursuers at the same development stage are called pursuers with the same development degree.

Pursuers with higher development degree have larger occupying. In a developing system, later particles usually have higher development degree than earlier particles. Particles in a stronger gravitational field have a larger developing speed difference.

Possible state: possible state is a combination of occupied from different pursuers. Every pursuer inputs and outputs occupied, similar to consumption and production in economy.

Market: market is the combination of all possible states. It corresponds to space-time in physics. Current market corresponds to space.

3. Deduce Quantum Electrodynamics from Science of Pursuit

When pursuers do not exchange occupying, they are called "independent pursuers". When studying "independent pursuers" only, it can be called "science about occupied exchange", which is Quantum Electrodynamics in physics. When pursuers exchange occupying, it is strong and weak interaction in physics. Quantum Electrodynamics is equivalent to "pursuit theory about how to make the best option of occupied". The proof is given as follows.

Axiom 1:

When only occupied exchange is considered, occupying is a constant.

Axiom 2:

For an independent pursuer, its pursued quantity from symmetrical occupying is the product of symmetrical occupying and experienced symmetrical occupied. Its experienced symmetrical occupied is the product of beginning choice and finishing choice.

From axiom 1, symmetrical occupying does not change in occupied exchange, so -S/m is experienced symmetrical occupied. In each pursuer's pursuit process, there must exist earlier beginning choice (B) and later finishing choice (F). Realization of pursued quantity includes two stages: "finish an earlier state and begin the present state" and then "begin the present state and finish a later state". So, the experienced symmetrical occupied in a short pursuit process is

(1) $$\mathbf{-S/m=F(x_i+dx_i)B(x_i)}$$

Experienced symmetrical occupied can also be F^nB^m, or even more complex, but (1) is the simplest. Experienced symmetrical occupied can be viewed as a flow from beginning choice to finishing choice, so it is natural to suppose that experienced symmetrical occupied is linear function of both beginning choice and finishing choice.

The mathematical expression for F and B will be decided when they satisfy the following axioms. They are wave function and its complex conjugate function.

Each pursuer has a lot of choices, But total choice at one moment is 1, and probability for pursuer to be at x_i is $F(x_i)B(x_i)$. In economy, people tend to say "desire for a commodity". In fact, desire and commodity are average values, similar to average momentum and average displacement in physics. So, economist should use beginning choice and finishing choice to describe economic behaviors.

Axiom 3:

Pursued quantity with completely different occupying or occupied is called "independent pursued quantity". Total pursued quantity is the sum of all independent pursued quantity.

Total pursuit process can be decomposed into many independent pursuit processes. Independent pursuit processes do not share any pursued quantity. Total pursued quantity is sum of pursued quantity from all independent processes. Any independent pursued quantity should be counted in total pursued quantity, and only once. So the best methodology for the pursued quantity will lead to the largest benefit for all occupying and occupied.

So the experienced symmetrical occupied is

(2) $$(-S_0)/m = \int F(x_i+dx_i)B(x_i)d\Omega$$

Axiom 4:

At any intersection of a pursuer's pursuit process, new pursuit process begins and old pursuit process finishes.

At an intersection of a pursuit process, there are two kinds of properties: those from the finishing of earlier pursuit and those from the beginning of later pursuit. It is one of the most important properties for pursuit. If any intersection satisfies axiom 4, pursuit is a process without beginning or ending.

The experienced symmetrical occupied for the old pursuit is:

(3) $$\int F(x_i)\, B(x_i-dx_i)=\int F(x_i)B(x_i)-\int F(x_i)(\partial/\partial\, x_i)B(x_i)dx_i$$

Similarly, the experienced symmetrical occupied for the new pursuit is

(4) $$\int F(x_i+dx_i)B(x_i)=\int F(x_i)\, B(x_i)+\int \partial F(x_i)/\partial x_i\, B(x_i)dx_i$$

In a perfect pursuit system, choices finish and begin simultaneously. At an intersection of a pursuit process, it includes half of the old pursued quantity and half of the new pursued quantity. So the pursued quantity from symmetrical pursuit is:

(5) $$(-S_0)=m\int FBdx_i+m/2\int (\partial F/\partial x_i)Bdx_i-m/2\int F(\partial B/\partial x_i)dx_i$$

At each intersection, there are three terms. They represent three flows of occupied: from present to present, from present to future and from past to present.

Axiom 5:

When beginning choices and finishing choices have several components, F_j and B_k, there are cross flows from F_j to B_k, and from F_k to B_j.

So (1) ought to be $F(x_i+dx_i)G_iB(x_i)$. Each "G_i" is a matrix. Each matrix represents an independent kind of flow style between beginning choices and finishing choices. F is a row vector, B is a column vector.

(6) $$(-S_0)=m\int F\, G_i\, Bdx_i+m/2\int (\partial F/\partial x_i)\, G_i\, Bdx_i-m/2\int FG_i$$

$$(\partial B/\partial x_i)dx_i$$

G_i must satisfy some conditions, like unitary condition. G_i corresponds to γ_i in Quantum Electrodynamics.

Axiom 6:

Pursued quantity from anti-symmetrical pursuit is the correction to that from symmetrical pursuit, which is the product of anti-symmetrical occupying and experienced anti-symmetrical occupied.

Pursued quantity in different conditions ought to be corrected. Good pursuit condition helps to increase pursued quantity, so its correction ought to be negative pursued quantity. The correction, $(-S_e)$, is opposite to influence of condition. Pursued quantity from symmetrical occupied is similar to sales volume, but corrected pursued quantity is similar to sales revenue. In economy, lower price leads to larger sales volume, which would lead to larger revenue if price were normal, but revenue must be corrected downwards. Pursued quantity from anti-symmetrical occupied corresponds to the correction to revenue.

Let A_j represents anti-symmetrical occupied in unit symmetrical occupied, similar to price in economics. Then $A_j dx_j$ is anti-symmetrical occupied along dx_i (similar to the revenue adjustment). Anti-symmetrical occupied has gauge invariance. In a perfect market, price system is gauge invariant. So, correction from pursuit condition is

$$(-S_e)=i\int qFG_kBA_kdx_k \tag{7}$$

$iqFG_kB$ is the flow of anti-symmetrical occupying, which corresponds to current j_k in the Universe. Imaginary unit i is separated from G_k just for convenience, to be more similar to Quantum Electromagnetics.

Axiom 7:

For both symmetrical and anti-symmetrical occupied, its expected pursued quantity is sum of all possible influences to pursued quantity.

An unoccupied state in market is possible to be occupied, so there is expected pursued quantity $(-S_A)$. In economy, unsold goods and unoccupied states are not valueless. This means market itself have value (pursued quantity). Expected pursued quantity for occupied is a statistical result.

Axiom 8:

In a perfect pursuit system, total pursued quantity is the sum of pursued quantity from symmetrical pursuit and pursued quantity from anti-symmetrical pursuit, plus expected pursued quantity. Total pursued quantity is the largest.

$$(8) \qquad \mathbf{(-S)= (-S_0)+(-S_e)+(-S_A)}$$

It means the sum of realized pursued quantity and possible pursued quantity. In economics, it represents realized profit plus expected profit. In (8), expected pursued quantity of anti-symmetrical occupied is included. That of symmetrical occupied should lead to Gravitational field.

The mathematical expression for $(-S_A)$ is given in theorem 1:

Expected pursued quantity for anti-symmetrical occupied is

$$(9) \qquad \mathbf{(-S_A)=(1/2)\int(\partial A_i/\partial x_j)(\partial A_i/\partial x_j)\, d\Omega}$$

Proof:

Since expected pursued quantity is statistical result of all possible choices, $(-S_A)$ is not a function of F_i and B_i. By variating F_i and B_i in (8), there is:

$$(10) \qquad \mathbf{(mG_i\partial/\partial x_i+m-iG_iqA_i)B=0}$$

$$(11) \qquad \mathbf{F(mG_i\partial/\partial x_i-m+iG_iqA_i)=0}$$

In economy，(10) and (11) means sales volume increase and price decrease reach marginal equilibrium. In other words, $(-S_0)$ and $(-S_e)$ reaches marginal equilibrium. By F×(10)+(11)×B, we get:

$$(12) \qquad \mathbf{\partial/\partial x_i(iqFG_iB)=0}$$

This corresponds to charge-current conservation law.

From (7), the first order influence of electromagnetic field is proportional to q, so, for all possible particles, total contribution to expected pursued quantity is zero. So we need to calculate the second order influence:

(13)$(-S_2)=m/4[B(\partial/\partial x_j\partial/\partial x_i)F+(\partial/\partial x_j\partial/\partial x_i B)F]dx_j dx_i$

Since

(14)$mG_i\partial B/\partial x_i=-mB+iG_i qA_i B$

(15)$mF(G_i\partial/\partial x_i)=Fm+iFG_i qA_i$

Calculating total sum of all possible states in $d\Omega$ ($d\Omega$ is invariant space-time volume) means calculating integral on surface $d\sigma_{ij}$ (perpendicular to x_j and x_i).

(16)$(-S_A)=m/4\int[B(\partial/\partial x_j\partial/\partial x_i)F+(\partial/\partial x_j\partial/\partial x_i B)F]d\sigma_{ij}$

$=m/4\int\partial/\partial x_i\partial/\partial x_j[B(\partial/\partial x_j\partial/\partial x_i)F+(\partial/\partial x_j\partial/\partial x_i B)F]d\Omega$

Replacing $\partial F/\partial x$ and $\partial B/\partial x$ by (15) and (14), in the results, terms without q representing expected pursued quantity for space-time, terms proportional to q and q^3 will be zero when all possible pursuers are considered. Term proportional to q^4/m^3 is much smaller than term proportional to q^2/m. So, terms proportional to q^2 is $(\partial A_i/\partial x_j)^2$, its coefficient is $1/2\Sigma(q_p{}^2/m_p)P_p$. q_p and m_p is charge and mass of one kind of pursuers. P_p is density of pursuer q-m in the Universe, (probability to find q-m in unit $d\Omega$). Since electron has smaller mass and higher percentage, m can be approximately treated as m_e. (End)

From theorem 1, by variating A_i,there is

$$\Sigma_k\partial^2 A_i/\partial x_k{}^2=j_i$$

This represents the marginal equilibrium between $(-S_e)$ and $(-S_A)$, which means there is microscopic equilibrium between expectation and realization. So, expectation equals to realization in perfect pursuit.

It can be seen that the pursued quantity satisfying the above axioms has the same mathematical expression as negative action in Quantum Electrodynamics.

Axiom 9:

In a perfect pursuit system, there are ordered two-dimensional supplies. Supply substitution forms market.

The substitution between supplies includes all possible changes of states. So pursuer has largest freedom (most choices) in a perfect pursuit system. Each substitution is a line (one-dimensional) in space. In society, the two-dimensional supplies are various supplies and their quantities. But various supplies are not ordered, which makes social market difficult to be perfect. More precisely, including the anti-symmetrical occupied, occupied comes from a two-dimensional complex quantity: supply-price.

If substitution rates between supplies are fixed, they are in the same development degree. All possible substitutions under the same development degree form a Euclidean space. When there are substitutions between different development degrees, the market is isomorphic with curved space-time.

Theorem 2:

Under the same development degree, all possible substitutions between different supplies form three-dimensional space, and invariant substitution forms one-dimensional time.

Proof: When substitution rate between two supplies is fixed, two-dimensional supply plus one-dimensional substitution will form three-dimensional ordered set. In society, if there are n kinds of goods, then there are $n \times n$ possible substitutions. When n becomes infinite, it forms a two-dimensional sphere. For each substitution, there is one-dimensional substitution quantity, corresponding to radius. So, there is three-dimensional supply-substitution market. There is only one direction of invariance: repeating the same combination of supplies. (End)

So, every perfect pursuit system has 3D space and 1D time.

Axiom 10:

For symmetrical pursuit, invariant substitution brings positive pursued quantity; variant substitution brings negative pursued quantity.

The positive direction is called "time". The three negative directions are called "space". In society and research, change also means negative pursued quantity, which cannot occur without compensation. In a perfect pursuit system with only one pursued quantity, there is only one positive direction, and whole system moves toward that direction.

So, in any local area, any small substitution ds can be divided into four independent substitutions, dx_i.

Theorem 3:

Locally, the four-dimensional market can be divided into four independent sets dx_i. Expected pursued quantity of symmetrical occupied determine algebra of dx_i. Locally, it will be

$$(17)\quad ds^2=dt^2-dx^2-dy^2-dz^2$$

dx_i is measurement of occupied, which is space-time distance in the Universe.

Proof: In a small pursuit process dx_i, pursued quantity can be expanded as $\Sigma a_n(dx_i)^n$. Since pursued quantity should be zero when there is no pursuit, n should be positive. Since $-dx_i$ ought to have the same expected pursued quantity, n cannot be odd. So for the lowest-order approximation, expected pursued quantity for space-time is $a_2dx_i^2$. If dx_i is defined as real number, from axiom 10, we must add "-" in front of spatial directions. Independent pursued quantity can be added, then

$$(18)\quad a_2dt^2-a_2dx^2-a_2dy^2-a_2dz^2=a_2ds^2$$

For the time direction, let dx_4 be idt, then ds^2 is $-\Sigma dx_i^2$.

So, geometry is result of pursued quantity calculation. Currently, calculation of negative action in physics and Euclidean geometry are independent knowledge. They are related in science of pursuit. In a small area, geometry is Euclidean and occupying can be treated as constant. But in a large space-time scale, either space-time becomes non-Euclidean or mass becomes a variable, see theorem 5 and 6. Length, area and volume are total expected pursued quantity in the region.

(End)

Axiom 11:

Whole pursuit system can be described as a large beginning choice and finishing choice. When two pursuit processes are mutually conditional, total beginning function is the product of the two beginning functions; when two pursuit processes are mutually independent, total beginning function is the sum of the two beginning functions. It is the same for finishing function.

When more processes are included, it means higher perturbation order in Quantum Electrodynamics. Process I and H can be mutually independent and as a whole conditional to J, so that then the total beginning function is $(B^H+B^I)B^J$. The total function will be conditional or independent with other pursuit processes, until whole system is included. Modern physics showed that it is calculable for such complex pursuit, and particles proved their calculation speed can be very fast.

Axiom 12:

When occupied is owned by occupying, it follows private ownership, which is Fermi-Dirac distribution. When occupied is not occupied, it follows public ownership, which is Einstein-Bose distribution.

Private ownership means any two pursuers cannot occupy the same state. All possible states that cannot be occupied simultaneously can be expanded as the superposition of anti-symmetrical wave functions. On the other hand, all public owned states can be expanded as the superposition of symmetrical wave functions. In a perfect pursuit system, realized pursuit follows private ownership, so they are fermions; unrealized pursuit follows public ownership, so they are bosons. If unoccupied occupied has expected pursued quantity, they can be treated as pursuers, but they are bosons.

These axioms form a set of rules for pursuers' pursued quantity. Knowledge about occupied can be deduced from mathematical expressions of occupying' pursued quantity, so physics can be greatly simplified.

4. Universe Expansion is System Development

In this part, the author will deduce classical physics as the first order approximation of quantum physics. Hubble red-shift and curved space-time are proved to be system development and development difference. It is proved that perfect pursuit system must expand, because pursuers will statistically increase occupying in anti-symmetrical occupied. In the Universe, it means particles absorb energy from electromagnetic field.

The first order approximation for $(\partial F/\partial x_i)B-(\partial B/\partial x_i)F$ is u_i, because pursuit desire for dx_i must increase with dx_i/ds. It means that occupying is approximately proportional to occupied. In society, it means that desire for a supply is proportional to the consumption ratio of the supply.

In the first order and in a small area, pursued quantity in a perfect pursuit system can be written in the following form:

(19) $d(-S)=-mu_i dx_i-qA_i dx_i+aF_{ik}^2 d\Omega$

In the Universe, u_i, dx_i/ds, is explained as four-dimensional velocity; F_{ik} is explained as electromagnetic field tensor; a is a positive constant.

In science of pursuit, pursued quantity (like negative action) is unnecessary to explain, and other quantities (like length and field) are explained by "negative action". For logic simplicity, it is better to explain all concepts from one abstract concept, not to explain one from many, although the one is more abstract. "Negative action" is abstract for human beings because they do not have the same feelings as particles, so they cannot understand particles' pursuit. Particles think "happiness" an abstract concept too.

In the first order, mu_i is apparent occupying; mcu_i+qA_i is its real occupying (P_i); pursuer's pursued quantity is the product of the real occupying and dx_i. So, the pursuer's pursued quantity is $\Sigma(P_i dx_i)$.

Since every state is possible to be occupied, the natural way to evaluate occupied is to sum up all possible influences to pursued quantity. If the Universe pursues rationally, the expected pursued quantity in whole Universe will be equal to the actually realized change of pursued quantity in whole Universe.

Theorem 1 is easier to prove in the first order approximation. By variating x_i in $-\int(mu_i+qA_i)dx_i$, a classical pursuer's best pursuit behavior satisfies:

(20) $m(du_i/ds)=qF_{ik}u_k$

In (20),

(21) $F_{ik}=\partial A_i/\partial x_k-\partial A_k/\partial x_i$

If the field area is small enough, F_{ik} can be treated as constants. So, for all possible states on a closed three-dimensional hypersurface C, after moving unit ds, expected negative action is

(22)$(-S_f)=-\int_C m(du_i/ds)dV_i$

$=-F_{ik}\int_C qu_k dV_i$

$$=F_{ik}^{2}\int_C(q^2/m)d\Omega$$

So there is theorem 4:

Statistically, pursuer's symmetrical occupying will increase in anti-symmetrical occupied. The expected absorption rate is proportional to $(\mathbf{E}^2+\mathbf{H}^2)/2$, which is expected energy for electromagnetic field.

Expected energy of electromagnetic field can be deduced from (19). Since pursued quantity of field is expected pursued quantity, momentum-energy of field represents expected momentum-energy. In a perfect pursuit system, total desire, sum of realized desire and expected desire, is a conserved quantity.

Suppose charges enter an enough small region uniformly from all directions. After unit time, there are three net movements. Firstly, there is a net current, which is proportional to **E**, because positive charges are accelerated toward **E** and negative charges toward **-E**. Secondly, there is a net current around **H**, because positive charges are accelerated clockwise and negative charges anti-clockwise (viewed along **H**). Their contribution to real energy is proportional to $(\mathbf{E}^2+\mathbf{H}^2)$. Thirdly, there is a net momentum, which is proportional to **ExH**, toward **ExH**, because the current toward **E** will interact with **H**. $(\mathbf{E}^2+\mathbf{H}^2)$ is always positive, so charges absorb energy from electromagnetic field statistically.

Kinetic energy of particles, including photons, is called unstable occupying. Particle's static energy is called stable occupying. From theorem 3, stable occupying will gradually absorb unstable occupying, so stable occupying increases monotonously in electromagnetic interaction. Unstable occupying will become part of static energy. If there were no new unstable occupying, unstable occupying would be exhausted and the pursuit system would stop developing (Universe would stop expanding).

In the Universe, ultimately speaking, all unstable occupying is generated from stable occupying through strong and weak interaction, and turns into stable occupying through electromagnetic interaction. From theorem 4, this circulation is self-magnified. If particles have larger stable occupying, they have stronger ability to "invest": create more unstable occupying in one fusion. So the Universe will expand forever.

Theorem 5:

Relative to pursuer’s growing stable occupying, past unstable occupying relatively depreciates with time.

Proof:

Since electron's static energy increases monotonously, atom radius reduces monotonously. When measured with a fixed energy-momentum unit, static energy increases with time. Suppose the speed is a constant,

(23) $d(m)/dt=Hm$

So, in fixed unit,

(24) $m(t)=m(0)\exp(Ht)$

Space-time geometry is decided by radius (of ruler atoms) and period time (of clock atoms). When atom radius reduces, clock is slower and ruler is shorter,

(25) $dx^i(t)=dx^i(0)\exp(-Ht)$

So, when perfect pursuit system develops, ruler is shorter and clock is slower with time. In order to measure correctly, observer needs to appoint his development degree. From time component of (25), we can deduce

(26) $dt/dt_0=1/(1+Ht_0)$

From (26), the time origin of a pursuit system with a uniform expanding velocity is -1/H no matter when it is measured. The reciprocal of the expanding velocity is the nominal time origin. For example, if developing velocity is 1% per year, economy is 100 years old in present unit. However, if we use local time unit to measure, there is no time origin. This is a property of exponential expansion.

Clock is very slow at the origin of the universe. If measured in present time unit, the evolution is very fast at the origin of the Universe. If a film shows the expansion of current universe at a very high speed (similar to being measured in a future unit), it will look like a Big Bang. But it is just a normal expansion when being shown slowly (measured in a local unit).

From (25), a small distance measured at the border of the Universe will be a long distance measured at the center of universe. From (26), clock is also very slow around the "border" of the Universe. The "border" of a perfect pursuit system is defined as the part of the system that can exchange with every pursuer at any time (can be observed by every observer at any time), because clock stops at the border. In perfect pursuit system, light velocity is the upper limit of pursuers' velocity, so any two pursuers can exchange with each other, but it is a point-to-point exchange. At the "border", a long time shrinks into a time point, so a border pursuer exchanges with other pursuers in a point-to-line way. When light is close to the border, it needs infinite long time to reach the border. A perfect pursuit system is infinite large because pursuers can never reach the border.

Atom's energy level is proportional to particle's mass, so energy level in the past is smaller than that at present, and light will have a red-shift. Maybe different particles can increase mass at different speed.

(27) $$df=f_0[\exp(-Hdt)-1]$$

f is frequency of light. When Hdt is very small, the red-shift is f_0Hdt. This is Hubble red-shift.

It can be seen that both m and dx change with development, but it is possible to introduce two other variables, dx^i and dx_i to make m invariant. Define

(28) $$dx^i=dx^0\exp(-Ht)$$

(29) $$dx_i=dx^0\exp(Ht)$$

Then

(30) $$ds^2=h_{ii}dx^idx^i$$

(31) $$h_{ii}=\exp(2Ht)$$

Theorem 6:

Space-time curvature comes from the difference of development degree.

Proof:

Development is not necessary to be uniform. The only limitation is: pursued quantity must be invariant, which means the whole pursuit system has only one goal. General form of (30) is

(32) $dx_i = h_{ij} dx^j$

This is first order approximation. So, expected pursued quantity for space-time is

(33) $ds^2 = dx_i dx^i = h_{ij} dx^j dx^i$

So distribution of development degree makes space-time curved.

Electromagnetic interaction decides how to make the best distribution and absorption of unstable energy. How to produce unstable energy the best ought to be decided by strong and weak interaction. All three interactions have the same aim: negative action pursuit. Matter and space-time are links in a close pursuit process, in which every link is expanding. If one link breaks, the other links could not expand.

5. Cosmology from Resource Equality

Theory about exchange in single market is foundation for general pursuit behaviors. In the above definitions and axioms, occupying and occupied are symmetrical: occupied and occupying can exchange their roles and still be a perfect pursuit system. In a perfect pursuit system, scarce resources can become abundant; abundant resources can become scarce. So there is axiom 13:

Resources are two two-dimensional complex continuities. Each feeling is a mapping between an abundant resource and a scarce resource. All resources follow the same laws in a perfect pursuit system.

This is called "resource equality". This axiom unifies particle and charge with space and field. In physics, it means mass-charge and space-field ought to follow the same laws. In perfect society, it means supply and demand ought to follow the same laws. In the viewpoint of pursuit, the difference just comes from the scarcity, and the scarcity leads to different statistics. Economy is the market where demands are scarce relative to supplies; and research is the market where demands are sufficient relative to supplies. So economy and research can be unified into "pursuit system of happiness", which is society. Similarly, space-field market is the market where mass and charge are relatively scarce; mass-charge market is the market that mass and charge is relatively abundant, which is black hole.

By proper combination, it is possible to construct a most scarce quantity and a most abundant quantity, which are called occupying and occupied respectively.

Substituting Abundant resources for abundant resources will be electromagnetic interaction; substituting scarce resources for scarce resources will be strong interaction; substituting abundant resources for scarce resources, or scarce resources for abundant resources, will be weak interaction. Gravity is the development difference, existing in every substitution.

Similar to two-dimensional complex occupied substituting two-dimensional complex occupied, two-dimensional complex occupying substituting with two-dimensional complex occupying will produce three-dimensional complex space, which has SU(3) symmetry. Substitution must have the same value, so it is unitary transformation.

For weak interaction, each resource can only substitute its mapping resource, which means a SU(2). In weak interaction, realized occupied can only substitute its occupying, not all occupying, and substitution must be equal value, so it is two-dimensional unitary complex transformation.

Since electromagnetic interaction is the perfect mechanism to expand space, what is the best mechanism to create particles and unstable energy? It is unnecessary to have another perfect mechanism to create them. If there is a symmetrical mass-charge market and a transformation mechanism between space-field and mass-charge, the two spaces can mutually provide particles and unstable energy.

Both abundant resources and scarce resources are pursuit resources, and should be equally treated. They split into two markets. In both markets, the scarce resources will be occupying, and the abundant resources will be occupied.

Axiom 13 ensures that the Universe will expand forever. From the axiom, the following theorems can be obtained. Every theorem can be deduced simply by exchange occupying with occupied.

Theorem 7:

Space and electromagnetic field in space-field market becomes mass and charge in mass-charge market. Mass and charge in space-field market becomes space and electromagnetic field in mass-charge market. Boson in space-field market will become fermion in mass-charge market; fermion in space-field market will become boson in mass-charge market.

When all occupied in one market becomes occupying in the other market, the two markets are mutually called perpendicular markets, like space-field market and mass-charge market. Our observing space-field market is just half of the Universe, in which mass-charge is scarce relative to space-field. There is another mass-charge market, in which space-field is scarce relative to mass-charge. By weak interaction, space-field market and mass-charge market can mutually transform and be mixed. It is possible to exist space-charge market and mass-field market. It is impossible to absolutely distinguish a mixed market from a pure market.

Mathematical expression of negative action in mass-charge market is similar to that in space-field market, just exchanging x_i with p_i, A_i with j_i. In mass-charge market, discrete A_i is surrounded by continuous j_i. A_i exchanges j_i to interact with each other. Neutrino in space-field market will become photon in mass-charge market, and photon in space-field market will become neutrino in mass-charge market. In mass-charge market, mass-charge has the best distribution for negative action pursuit.

Statistics will also change. From axiom 12, abundant resources follow Bose-Einstein Statistics; scarce resources follow Fermi-Dirac Statistics. So, fermions in space-field market will become Bosons in mass-charge market; bosons will become fermions there.

Propagation of electromagnetic field in mass-charge market is observed as particles interacting with each other in space-field market. For example, neutrino interacting with neutron will generate proton and electron, similar to that photon is electromagnetic field undulation.

When the density of occupying is high enough, k-space is not only a useful mathematical tool, but also real existence. When there are much more mass-charge than space-field, mass-charge market is a much better description than space-field market. Black-hole is just the situation.

In both markets, scarce resources are thought to be more active in pursuit. Adaptive behaviors of anti-symmetrical occupying (through electromagnetic interaction) will weaken undulation of anti-symmetrical occupied. Adaptive behaviors of symmetrical occupying (through gravitational interaction) strengthen undulation of symmetrical occupied. When energy is high enough in space-field market, there is no difference with mass-charge market.

Theorem 8:

The two markets exchange with each other through black-holes. Black-hole in one market is active galactic nucleus in the other market. Black-holes in a market make occupying more scarce in the market, and make occupying less scarce in the other market.

A black hole in space-field market will be an active galactic nucleus in mass-charge market, and leads to the formation of a galaxy in mass-charge market. After some time, there will exist stars and finally black holes in mass-charge market, which will be active galactic nucleuses in space-field market. So young black holes are normally one-way, but old black holes will be two-way: as black hole and active galactic nucleus in both market.

Since there are black holes in each market, the two markets will exchange with each other. A black hole in mass-charge market will disassemble its space-field into fermions in space-field market. In a space-field market black hole, there may be many mass-charge market black holes and they cannot be distinguished. So those mass-charge market black holes just output particles and energy to space-field market. Older black holes in space-field market will produce more and larger black holes in mass-charge market, so they can output more particles and energy to space-field market.

Weak interaction leads to pursuer jumping between spaces. When scarcity of resources changes, weak interaction changes intensity and leads to one-way evolution. So occupying in one market turns into occupied in the other market.

Theorem 9:

Strong interaction in space-field market is electromagnetic interaction and vector addition in mass-charge market; electromagnetic interaction and vector addition in space-field market is strong interaction in mass-charge market. Weak interaction is exchange between occupying and occupied.

Since expected pursued quantity changes with scarcity, measurement of resources are different in different markets. Occupying is always realized, their expected pursued quantity is proportional to resource, so charge and mass can be added linearly in space-field market, but cannot when they become occupied in mass-charge market. In mass-charge market, charge has expected pursued quantity F^2_{ik}; mass has expected pursued quantity $ds^2=dt^2-dx^2-dy^2-dz^2$. In mass-charge market, calculation of strong interaction can be simplified as vector and electromagnetic field addition.

Each market is measured by its occupied. When occupied in space-field market is used to measure mass-charge market, mass-charge market is very small and vice versa. In black holes, there is another world just like our observing space-field market.

If a pursuer is a mapping between occupying and occupied, then there are three possible interactions: exchanging occupied, exchanging occupying and exchanging occupying with occupied. They are electromagnetic and gravitational interaction, strong interaction and weak interaction.

There is a simplest way to describe each market, in which occupied is the most abundant among all possible descriptions and the occupying is the scarcest. In the simplest description, most exchange is classified as electromagnetic interaction; least exchange is classified as strong and weak interaction.

Since human beings can originate inside the Universe, another astonishing experimental result is: new pursuit systems, even perfect pursuit systems can originate inside a perfect pursuit system. This means new perfect system can origin inside perfect society. Human beings can be the creator of a new world.

From above, theory about perfect pursuit system is formalized. Any pursuit system satisfying these axioms will have the same results. For example, imagine universe as a society and each particle a person. Treat a particle's negative action as happiness. Thinking about every complex interaction between particles as happiness exchange between persons, a particle choosing state to have the largest negative action corresponds to a person choosing state to have the largest happiness. So, the Universe can be logically reproduced in any pursuit system.