THE QUANTUM OF PROBABILITY

BY

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The zero point energy field.

Probably the most vexing aspect of quantum theory and the aspect which remains unsolved and unexplained is the fact that its postulates appear to contradict every day experience and to defy "common sense", the most obvious example of this being so-called action at a distance and the fact that an observation made at one point in the universe seems instantly to affect the outcome of an event light years away in another part of the universe. Factors such as this can only lead to the conclusion that the quantum world is indeed very different from the classical world of every day experience and that it is best to accept this phenomenon as a fact and instead of trying to explain quantum theory in terms of our every-day experience that we look for explanations elsewhere.

There are two a-symmetries which manifest themselves in quantum theory both of which are well known but which merit further comment. The first a-symmetry was clearly described by Penrose in 1989 and it is well worth repeating here.

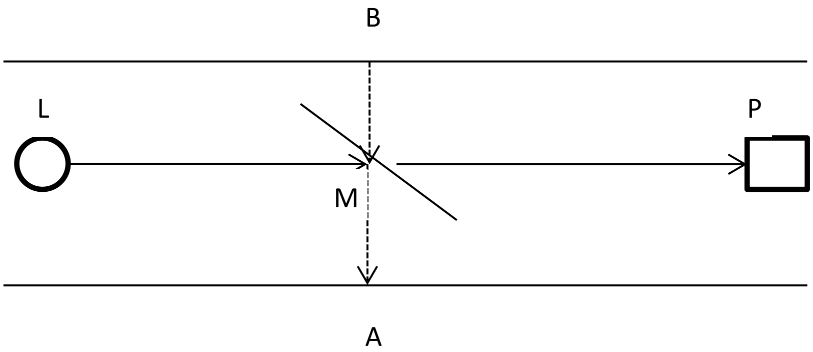

Fig.1

The experiment shown above illustrates the time irreversibility of a quantum experiment. Here we have a lamp L and a photocell P. between L and P there is a half silvered mirror at an angle of 45^0 to the line LP. A photon is emitted at L. The photon's wave function strikes the mirror and the wave function splits into two. There is an amplitude of $\frac{1}{\sqrt{2}}$ for the reflected part of the wave and an amplitude of

$\frac{1}{\sqrt{2}}$ for the transmitted part of the wave and the probability given by the square of the moduli of these two amplitudes i.e.

$\left(\frac{1}{\sqrt{2}}\right)^2 = \frac{1}{2}$ defines the alternatives. Therefore we can answer the question "Given that L registers, what is the probability that P registers?" and the answer we get is "one half". However the time reverse of this question is "Given that P registers, what is the probability that L registers?" and the answer to the question is not one half --- it is "one".

More properly we can say that the eigenstate which is detected when the wave function collapses can only be a state which is moving forward in time. There are two implications to be drawn from this experiment. The first is that time does not flow and therefore does not have any direction at the quantum level and the second is that as time does not flow then entropy does not increase at the quantum level and from which we can conclude that the flow of time at the classical level is a-symmetrical.

The second a-symmetry to be considered is that as defined by Bell's Inequality which describes the probability of the outcome of the spin state of a quantum system. Generally Bell's Inequality is expressed in the direction of spin of a particle, but instead of measuring the spin state , in this case we will measure the total angular momentum and therefore the probable total energy of the system.

If we take a two wing apparatus with the wings denoted *a* and *b* respectively, convention has it that the experiment has the objective of measuring the probability of the direction of spin in either one or both of the arms of the experiment. However in this case the objective is to measure the probability of the direction of spin and angular momentum and therefore the energy of the particle. Thus the probability of the direction of spin and probability of the energy level being the same and the probability of the direction of spin and the energylevel being different can be expressed as the difference between two probabilities i.e. $|Q\rangle(a,b)$ thus:-

$$|Q\rangle(a,b) \equiv P[|Q\rangle\uparrow, |Q\rangle\uparrow: a,b] + P[|Q\rangle\downarrow, |Q\rangle\downarrow: a,b] - P[|Q\uparrow\rangle, |Q\downarrow\rangle: a,b] - P[|Q\downarrow\rangle, |Q\uparrow\rangle: a,b]$$

If this exercise is repeated by taking four experiments with direction a and a' in one wing of the apparatus and b and b' in the other wing the result is:-

$$X(a,b,a'b') \equiv [|Q\rangle(a,b) - |Q\rangle(a'b') + |Q\rangle(a,b) - |Q\rangle(a'b')] \leq 2$$

Equ.1.

Obviously this is a derivation of Bell's Inequality and in this particular case it is used to define the general energy state of a classical system as well as the direction of spin and shows that in a classical system some energy is lost from the system to the environment during the transition from the quantum state to the classical state. This becomes apparent when we note that the inequality is violated in quantum theory because in quantum theory $|Q\rangle(a,b) = -cos(a-b)$. For example if $a = 0^0, a' = 90^0, b = 45^0, b' = -45^0$ then $\mathrm{X}(a,b,a'b') = 2\sqrt{2}$

Equ.2.

which is a clear violation of the classical inequality. So at this point we have a situation where in quantum theory angular momentum and energy are conserved at the quantum level and are not lost to the environment as long as the quantum system remains closed. Thus we can conclude that there is no change in entropy of the quantum system until the equality in the symmetry of the quantum state is violated at the point of the interface between the quantum world and the classical world which re-enforces the notion that time does not flow at the quantum level. Furthermore this accounts for the difference in energy levels between the probability function of energy at the classical level in Equation 1 i.e. ≤ 2 and the probability function of energy at the quantum level in Equation 2 i.e. $= 2\sqrt{2}$. This can be expressed as :-

$$Q_{2\sqrt{2}} \rightarrow P_{2\sqrt{2}} - P_{2\sqrt{2}-2} \qquad \text{Equ.3}$$

Here Q is the total probability at the quantum level and $P_{2\sqrt{2}-2}$ is the probability state of the classical universe and $P_{2\sqrt{2}}$ is the probability state of the quantum universe. The change in probability from $2\sqrt{2}$ to ≤ 2 implies that a surplus probability of energy is carried away by some at present, unknown particle. This leaves a state where there exists a surplus energy/probability level somewhere between $2\sqrt{2}$ and 2 and therefore Equation 3 can be re-written as :- $Q_{2\sqrt{2}} \rightarrow P_{2\sqrt{2}} + P_{2\sqrt{2}-2} + \gamma_{\approx 2}$ where γ represents the unknown particle. The decay energy of this process is given by:-

$E_{2\sqrt{2}} = \left(P_{2\sqrt{2}} - (2\sqrt{2}-2) - 2m_{\gamma}\right)c^2$ where m_{γ} is the negative mass of the unknown particle which has a mass/energy/probability level between $2\sqrt{2}$ and 2 and the percentage difference carried away is up to some 65% of the total energy of the quantum system. From the foregoing it should be noted that the unknown particle carrying away the excess energy of the quantum transition state is a particle of negative mass and which constitutes the main component of a negative energy or Dark Matter field which, Is submit, is present throughout the entire structure of space-time (see below). This negative field manifests itself as a repulsive field which acts on quantum events in the manner of a repulsive gravitational force. This being the case we can hypothesize that a quantum event consists of a spherical wave of probability which increases in volume under a repulsive gravitational field acting on the system. In this case the wave of probability at the quantum level has a frequency which changes under the effect of a gravitational field. The change in frequency of a probability wave can be described as the work done on the gravitational potential of the system as $W = \int_{\emptyset_1}^{\emptyset_2} F_x(x)\, dx$ thus

$\emptyset_2 - \emptyset_1 = -\int_{\emptyset_1}^{\emptyset_2} = -F_x\,(x)dx$ that is to say the change in potential is the manifestation of a force $F_x(x)$ caused by the change in frequency of a probability wave. The force F_x can be expressed as $F_x = g\frac{f_2}{f_1}r^2$ i.e. the force is proportional to the square of the distance from the origin.

Similar effects can be observed in a system where the gravitational effects of a probability wave are manifest. The change in gravitational potential energy caused by a change in frequency of probability wave can be described if a probability wave of frequency f_1 exists at a point where gravitational potential is low and which is symbolised by $\emptyset_1$ then the probability frequency f_2 when measured at a place where gravitational potential is high and is symbolised by $\emptyset_2$ is given by $f_2 = f_1\left(1 + \frac{\Delta\emptyset}{c^2}\right)$ where

$\Delta\emptyset = \emptyset_2 - \emptyset_1$and $f_1 = \frac{f_2}{1+\frac{\Delta\emptyset}{c^2}}$ and solving for $\Delta\emptyset$ we can write

$\Delta\emptyset - c^2\left(1 - \frac{f_2}{f_1}\right)$

Now we can note that *z* represents the frequency of a probability wave under the influence of a gravitational force is $z = \frac{gr}{c^2}$ and therefore $g = \frac{c^2 z}{r}$ and $g = \Lambda = 4\pi G\rho$ which is the same expression as derived for a repulsive gravitational force thus at this point probability and gravitation are unified.

Since *z* is equivalent to the potential difference $\Delta\emptyset$ we can write:-

$\Delta\emptyset = z = -c^2\left(1 - \frac{f_2}{f_1}\right)$. The expression $2\sqrt{2} - \leq 2$ represents an increase or a change in the potential difference between two states so that $\frac{c^2 z}{r} = g = \Delta\emptyset = -c^2\left(1 - \frac{f_2}{f_1}\right)$. A change in potential difference is equivalent to a change in potential probabilityand therefore as the change in the wave function from the quantum state to the classical state is due to the action of a gravitational force on the quantum state,

Treating the wave of probability as a field which is increasing in volume under the influence of a repulsive gravitational field we can expand the foregoing hypothesis further by describing the parameters which affect the probability field and define more precisely the nature of the repulsive gravitational force.

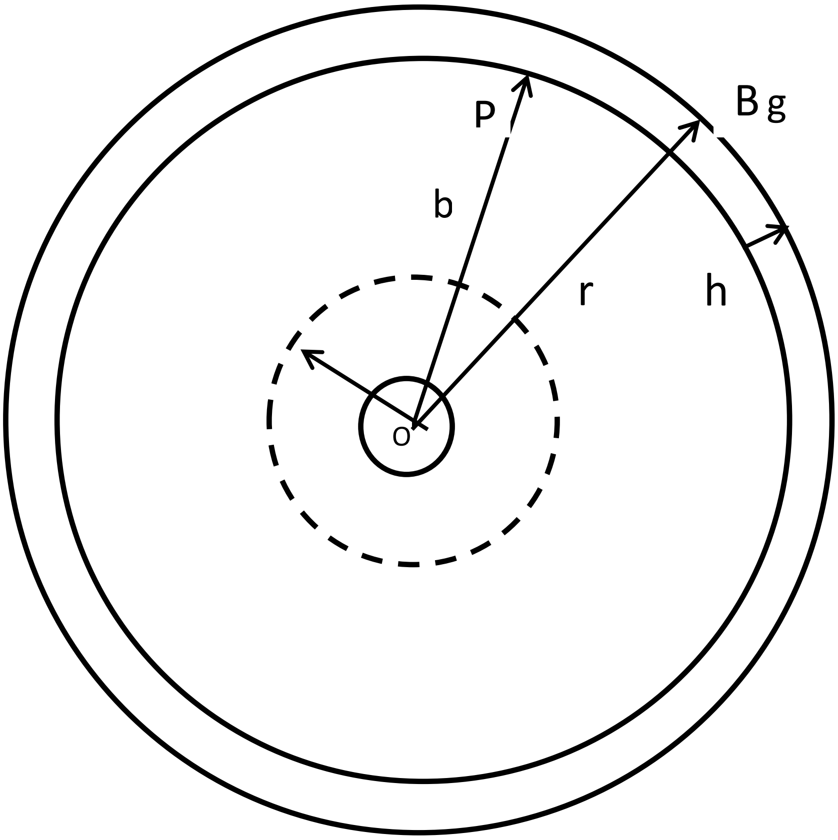

Fig.2.

The gravitational field strength increases linearly with distance and the gravitational acceleration at P is due entirely to the shell of thickness h=r-b. The total probability contained in the sphere is:-

$$Q = G\rho\frac{4\pi r^5}{3} - \frac{4\pi b^3}{3} = r^3 - b^3 G\rho$$

And since h=r-b and b=r-h we can write :-

$$Q = 4\pi \left(\frac{r-b}{h}\right)^2 G\rho \qquad \text{Equ.4.}$$

Therefore the acceleration due to gravity is due entirely to the area $4\pi r^2$ therefore $g = \Lambda = 4\pi G\rho$ because $r = b$ where $r - \frac{b}{h}$ =1.

In Equation 4, Q represents the total probability of the system outside the Planck radius which must be conserved under the conservation rules however here we are dealing with a repulsive gravitational field and therefore the force acting on any point within the sphere is given by:-

$g = \frac{QR}{4\pi G R_0^3}$ $\qquad R \leq R_0$ and similarly we can note that:-

$g = \frac{Q}{4\pi G r^2}$ $\qquad$ that is to say that Q is distributed evenly over the surface of the sphere and therefore $g = \Lambda = 4\pi G\rho$ as previously stated.

The expression representing the loss of energy incurred following the collapse of the wave function is $E_{tot} = 2\sqrt{2} - \leq 2 + 0.83$ where $2\sqrt{2}$ represents the energy of the quantum system, ≤ 2 represents the energy of the classical system and 0.83 represents the energy carried away by an unknown particle. Since this new particle is the product of a negative force it’s energy is by definition negative and it becomes a part of the dark energy which is the source of the negative and repulsive gravitational field. In other words the energy of the quantum state can be expressed as $2\sqrt{2} \rightarrow \leq 2 + \gamma$ which can be written as:-

$$2\sqrt{2} = 2 + 0.8284$$

$$\therefore \sqrt{2} = \frac{2.8284}{2}$$

$\therefore \sqrt{2} = 1.4142$

$2 = \pm(1.4142)^2$ Equ.5

And thus we conclude that γ has both positive and negative solutions and that the value of γ cannot be less than ± 0.8284 which represents the probability of the energy carried away at the point of the collapse of the wave function. It is interesting to note that the expression

$E = \pm\frac{\sqrt{\leq 2+\gamma}}{2}$ also indicates that the wave function $\leq 2 + \gamma$ has undergone a reflection and a change of wavelength $\frac{\lambda}{2}$ of 180^0. This phenomenon is more clearly shown in Fig.3 (see page 14) where we note that the point *0* can be described as a transpose of the area *A*,*B*,*C*,*D* and therefore we conclude that the volume of space bounded by *A*,*B*,*C*,*D*,*E*,*F*,*G*,*H* is contained within the point *0*. Similarly the volume *A'*,*B'*,*C'*,*D'*,*E'*,*F'*,*G'*,*H'* is a total reflection and rotation of the volume A rotated through 180^0 and projected at *B*. Figure 3 demonstrates an interesting aspect of the duality of space-time at the quantum level by introducing the real and imaginary axes of the diagram shown in Fig.4 which further reinforces the argument for and confirms the validity of the expression $2\sqrt{2} \rightarrow \leq 2 + \gamma$.

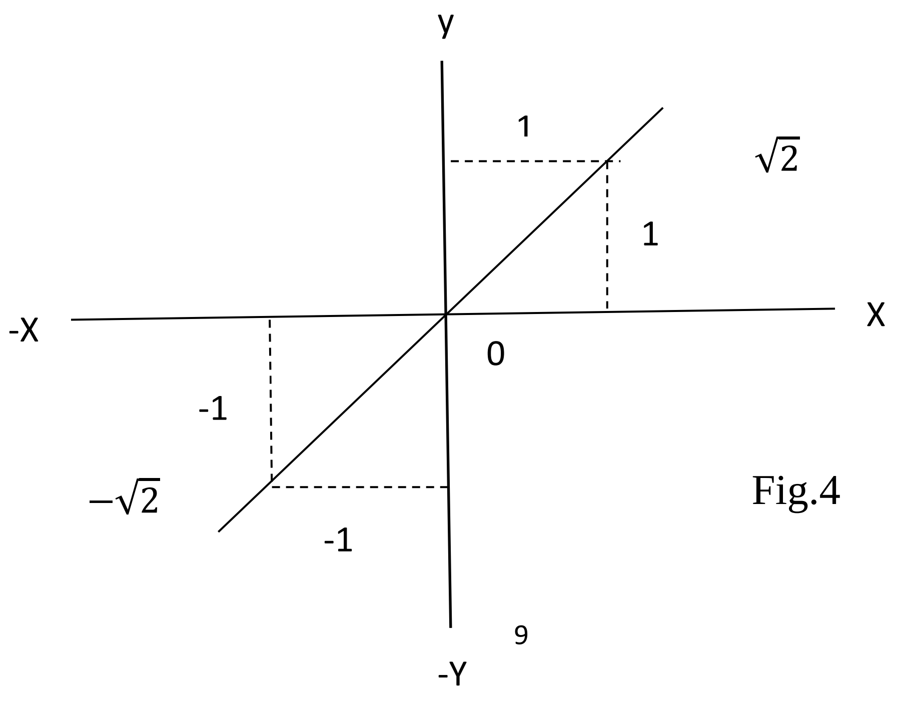

Fig.4

Since $x + iy = cosA + isinA$ then $x - iy = \cos \pi$ and thus we can infer that $x = iy = -1$ it follows that $e^{\pi i} + 1 = 0$ and $e^{\pi i} - 1$.Thus $e^{\pi i} + 1 = 0$ represents an identity and therefore at that point both space and time cease to exist in the generally accepted three or four dimensional form.

Coincidentally an interesting outcome of this observation concerns the proposed preponderance of dark energy and/or dark mass in the universe. Referring again to Fig.4we can note that the modulus of the proposition can be written as:-

$$|-1 - i1| = \sqrt{1+1} = \sqrt{2}$$

$$\therefore Arg(-1 - i1) = \left(\pi - tan^{-1}\frac{1}{1}\right)$$

$$= -\left(\pi - \frac{1}{8}\pi\right)$$

$$= \frac{7}{8}\pi$$

Similarly:-

$$|1 + 1| = \sqrt{1^2} + \sqrt{1^2} = \sqrt{2}$$

$$\therefore Arg(1 + 1) = tan^{-1}\left(\frac{1}{1}\right) = 45$$

$$= \frac{1}{8}\pi$$

In other words depending on whichever observation point one adopts, then one dimension has a preponderance over the other.

We can sum up by re-stating that the quantum world exists only at the point *O* where time does not flow and also that the classical world only comes into existence as the wave front expands. Expansion of the wave front is triggered at the point of interface between two opposing gravitational fields as previously described.

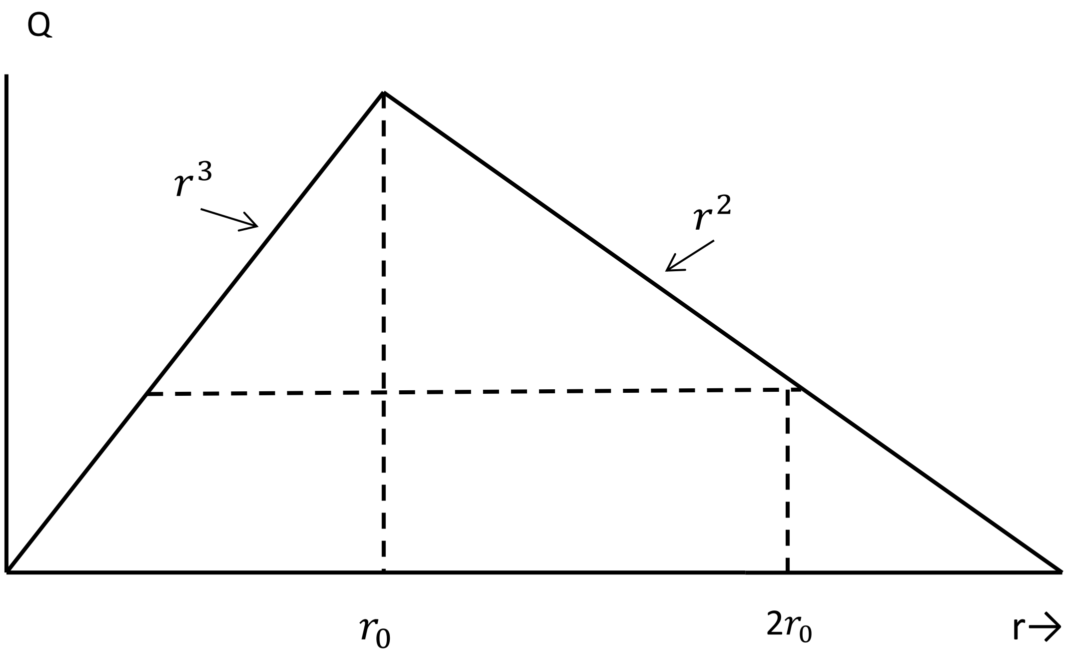

Fig.5

The probability field increases in strength with r inside the sphere i.e. there is no Λ factor within the sphere with radius up to the Planck length l_p thus :-

$Q = \frac{\rho r}{4\pi G r_0^3}$ $\quad (r < r_0)$ where ρ = probability density or value as $r \rightarrow r_0$ and here at the point r_0 the probability energy or field strength $= 2\sqrt{2}$ and is confined within the sphere.

Outside the probability sphere with $r > r_0$ we have :-

$$Q = \frac{\rho r}{4\pi G r^2} \qquad (r > r_0)$$

And here the probability field strength $=< 2$ and declines with distance from r_0 thus $2\sqrt{2} \rightarrow \leq +\gamma$ where γ represents a new particle whose strength increases in inverse proportionality to r. This is similar to a Λ force which increases with distance from a point source.

Because the strength of the new particle γ increases inversely to r, this represents an acceleration of γ represented by g_γ where $g_\gamma = \Lambda = 4\pi G\rho$.

The expression $2\sqrt{2}$ indicates that the quantum world is entirely deterministic whereas the expression ≤ 2 indicates that the classical world is non-deterministic. Both these statements are contrary to the popularly held belief that it is in fact the quantum world that is uncertain and non-deterministic. Further with regard to the fundamental differences between the quantum and classical states it has previously been noted that at dimensions within the Planck length l_p time does not flow because quantum events are reversible in time. Similarly one can hypothesise that other physical phenomena may contain in themselves a property of duality one of these being gravitation. Since gravitation is instrumental in regulating the flow an velocity of time one can infer that because time does not exist at the quantum level then gravitation can have no influence at the quantum level. In other words gravitation does not exist at the quantum level which may explain why it is that gravitation itself cannot be quantised. (Note: this is contrary to my previously held view that gravity does exist at the quantum level.)

Gravitation therefore only manifests itself at distances greater than the Planck length and it is repulsive or negative gravitation which exerts its influence at distances greater than r_0 (see Fig.5)

The negative gravitational effect resulting from the production of negative mass and energy which in turn results from the phase change of the wave function which occurs at the point r_0 (see Fig.5) enables us to calculate the value of g within the sphere i.e. $g = \frac{c}{t_p}$ where

t_p = Planck time and thus:-

$$g = \frac{3x10^8}{5.4x10^{-44}} = 5.6x10^{51} m.s^{-2}.$$

The value of *z* at the quantum level where $l_p = r_0$ we again note that $z = \frac{gr_0}{c^2}$ and therefore:-

$$z = \frac{(5.6x10^{51})x(1.6x10^{-35})}{9x10^{16}} = \frac{9x10^{16}}{9x10^{16}} = 1$$

We have previously noted that $g = \Lambda = 4\pi G\rho$ so if both G and z are normalised to 1we can write $\Lambda = \frac{c^2}{r_0} = \frac{9x10^{16}}{1.6x10^{-35}} = 5.6x10^{51}$

$$\therefore \Lambda = g.$$

The force required to initiate the expansion of the spherical wave to distances greater than r_0 is given by:-

$F = m_p g = (2.1x10^{44})x(5.6x10^{51}) = 1.18x10^{44}N$. where $m_p =$ Planck mass and the energy required is :-

$W = E = (1.2x10^{-35}) = 2x10^9 joul$. which is equivalent to the Planck energy. That is to say that this is the minimum amount of energy required to be input by the probability field to initiate the phase change from r_0 to *r* see (Fig.5). Because there is a change of frequency under g this means that $2\sqrt{2} - \leq 2$ is quantised and the change in potential within the probability field can be described in terms of frequency as:- $\Delta\emptyset = -c^2\left(1 - \frac{f_2}{f_1}\right)$. This leads to the further conclusion that is a repulsive gravitational field $\emptyset$ decreases with distance from the point O because the gravitational force is due entirely to the area of the sphere described in Fig.2. Thus as ≤ 2 approaches *0* an increasing amount of energy is lost to the system and total energy is conserved in the form of dark energy (see Equ.5).

END

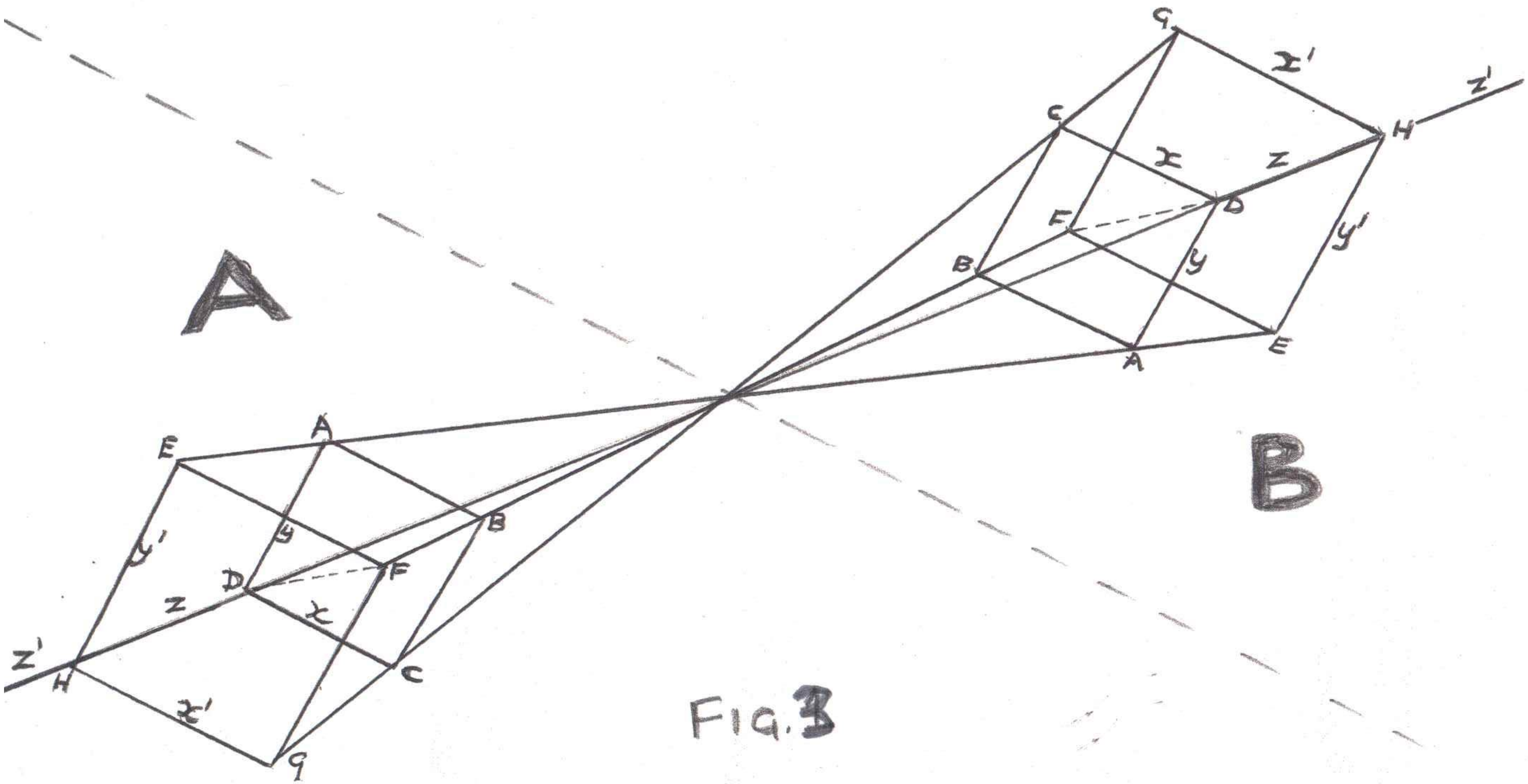

Fig. 3

Z