UNIFIED THEORY'S NEW PRINCIPLE OF NULL ACTION

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Quantum Theory's Uncertainty Principle violates conservation of energy & momentum and invokes matter's *unrealistic* creation from, and dissolution into, nothing. In Unified Theory action is an evolute of sharmon with Planck constant h as its quantum. The inviolable conservations of energy and momentum ordain conservation of action, invalidation of the Uncertainty Principle and introduction of the new Principle of Null Action. It has universal applications and is conceptually superior to the old Hamilton's Principle of Least Action as the latter unrealistically associates turnover of action NOT with variations in but with *constant* energy & momentum. In Nature, the path chosen by an isolated closed system during a real physical change through a succession of intermediate states from the initial equilibrium state `a' to the final equilibrium state `b' is such that the summation or integration of action covering all variations of energy or momentum is zero or null. Hence the name: "Principle of Null Action". The new principle has successfully derived the generally accepted equations for the following: Schwinger's Quantum Dynamical Principle, Klein-Gorden Field Equations, Schrodinger Wave Equation, Special and General Relativity, Euler's Equations, Lagrange's Equations, Maxwell Equations for Electromagnetic Radiation, Newton's laws of motion, Thermodynamic Equation of State, Discharge of Capacitance through Inductance & Resistance.

Quantum Theory's Uncertainty Principle violates conservation of energy and momentum and invokes matter's unrealistic creation from, and dissolution into, nothing. Our Unified Theory [1, 2] rejects it as unrealistic and re-asserts the inviolability of the conservation of mass-energy and momentum. The 'action' ($\Delta E.\Delta t$ or $\Delta p.\Delta x$) being associated with the variation ΔE in energy E or Δp in momentum p is also therefore conserved. This leads to the Unified Theory's new Principle of Null Action. It is conceptually superior to the conventional Hamilton's Principle of Least Action as the latter unrealistically associates turnover of action with *constant* energy or momentum. This is further clarified in sec. 2 below.

1. Enunciation of the Principle of Null Action

In Unified Theory [2] 'action' is a dynamic evolute of the sharmon as a physical quantity. Its quantum is the Planck constant h. Any and every variation ΔE in energy E or Δp in momentum p is associated with a turnover ΔA of action A. An increase in energy or momentum generates the action and a decrease expends it:

$$\pm\Delta E . \Delta t = \pm nh, \quad .... (1)$$
$$\pm \Delta p . \Delta x = \pm nh. \quad .... (2)$$

Here ΔE and Δp are the objectively actual variations, in contrast to the subjectively observed uncertainties of Heisenberg Uncertainty Principle. The natural conservation of energy and momentum ordains the conservation of action too.

In Nature, the path chosen by an isolated closed system during a real physical change through a succession of intermediate states from the initial equilibrium state `a' to the final equilibrium state `b' is such that the summation or integration of action covering all variations of energy or generalized momentum is zero or null. Hence the name: "Principle of Null Action".

The summation applies to the micro phenomena wherein the quantum nature of action is revealed. In macro phenomena of gross physical changes the 'graininess' of action cannot be appreciated and hence it appears as a continuous physical variable, calling for the integration.

A general case involves inter-conversions between two sets of form of energy or generalized momentum E_x (x = 1, ..., n_1) and E_y (y = 1, ..., n_2). The total action integral

$$A = \int (\sum \delta E_x - \sum \delta E_y) \, dt = 0,$$

or $$A = \int \delta F \, dt = 0, \qquad \qquad ....(3)$$

where $$F = \sum E_x - \sum E_y. \qquad \qquad ....(3a).$$

Here F is a twice differentiable continuous function of n physical variables q_k (k = 1, 2 , 3 , . . , n) of which one, say $q_m = t$, is parametric and canonically conjugate to E, and of q_k's mutual derivatives $q_{kr} = dq_k/dq_r$ (r = 1, ..., m-1, m+1, ... , n) which in themselves are continuous functions of q_k. That is,

$$F = F (q_k, q_{kr}).$$

The above equations lead to the following "*working equations*" of this new Principle of Null Action:

$$d/dq_r (\partial F/\partial q_{kr}) - \partial F/\partial q_k = \partial F/\partial q_r . q_{rk} \quad .... (4)$$

Their application to any specific case requires expressing F in a suitable form and then solving the resultant (n-1) differential equations.

2. Hamilton's Principle of Least Action vs Principle of Null Action

In a mechanical system, natural transformations involve inter-conversions between the kinetic energy T and potential energy V, so

$$F = T - V = L, \text{ the Lagrangian.}$$

Equation (3) transforms to

$$A = \int \delta L \, dt = 0. \qquad \qquad ...... (5)$$

It is operationally equivalent to Hamilton's Principle of Least Action

$$A = \int L \, dt = 0. \qquad \qquad ..... (6)$$

The Unified Theory's concept of associating action turnover with the variation ΔE in energy E and hence with ΔL or δL in the Lagrangian L as in equation (5) is more logical and realistic than with the unvaried Lagrangian L of Hamilton's Principle equation (6).

3. Schwinger's Quantum Dynamical Principle

Schwinger [4] developed a new Quantum Dynamical Principle on Heisenbergian Quantum Mechanics when the Hamilton's Principle was found inadequate for extension to micro quantum phenomena. If the Lagrangian L (ϕ, ϕ_u) is a function of the localized field ϕ and its gradient $\phi_u = d\phi/dx_u$ (u = 1, 2, 3, 4),

$$\delta A = \delta \int L \, dt = 0.$$

But the non-commuting observables ϕ, ϕ_u cannot be simultaneously measured at any time. Therefore δA cannot be computed. Moreover, Heisenberg's Principle of Uncertainty sets $\delta A \geq 0$, not identically equal to zero. However, Schwinger showed that

$$\delta (\phi_1, t_1 \mid \phi_2, t_2) = i/h \, (\phi_1, t_1 \mid \delta A \mid \phi_2, t_2) \qquad ...(7)$$

are the elements of transformation matrix wherein the necessity of vanishing of δA is removed. Nevertheless, even in eqn. (7), the ϕ_1 and ϕ_2 are not actual magnitudes but the measured observables subject to uncertainties of the Heisenberg Uncertainty Principle.

In Unified Theory's Principle of Null Action the ϕ and ϕ_u being objectively actual magnitudes, belong to the same eigenstate and hence commute.

Therefore, the Principle of Null Action can be applied and extended to the micro phenomena of Quantum Mechanics as below.

4. Klein-Gorden Field Equations

Let the Lagrangian density L (ϕ, ϕ_u) be a function of the scalar field ϕ (of mass m) and field gradient ϕ_u, without explicit dependence on space-time coordinates x_u, x_4 = ict, c being the light velocity in vacuum. Here,

$$F = L = \tfrac{1}{2} \, (\partial\phi/\partial x_u . \partial\phi/\partial x_u - m^2\phi^2), \quad q_k = \phi, \quad q_r = x_u,$$
$$q_{kr} = \partial\phi/\partial x_u, \qquad d/dq_r \, (\partial F/\partial q_{kr}) = \Box \, \phi,$$
$$\Box = (\partial^2/\partial x_1^2 + \partial^2/\partial x_2^2 + \partial^2/\partial x_3^2 - 1/c^2 . \partial^2/\partial t^2);$$
$$\partial F/\partial q_k = -m^2 \, \phi, \qquad \partial F/\partial q_r = 0.$$

With these substitutions, eqn (4) leads to the Klein-Gorden eqn :

$$(\Box + m^2) \phi = 0.$$

5. Schrodinger Wave Equation

In Unified Theory, the kinetic energy E of a moving particle comprises an aggregate of 0-spin sharmons with an intrinsic electric-cum-magnetic dipole whose natural frequency ν is related to E by $\nu = E/h$.

This induces electromagnetic dipoles of the same frequency ν in the ambient sharmon medium to generate the "sharmon ripple" tightly associated and moving with the moving particle at its velocity u. Its wavelength λ is related to the particle's momentum p by $\lambda = h/p$.

For a particle of mass m, moving with velocity u, momentum p, total energy T and potential energy V, $p^2 = m^2u^2 = 2m(T - V)$. This with the wave equation

$$\nabla^2 \Psi + 4\pi^2/\lambda^2 \, \Psi = 0, \quad \nabla^2 = (\partial^2/\partial x^2 + \partial^2/\partial y^2 + \partial^2/\partial z^2)$$

gives the famous Schrodinger Wave Equation of Wave Mechanics

$$\nabla^2\Psi + (8\pi^2 m/h^2)(T - V)\Psi = 0.$$

Lewis de Broglie was the first to give eqns. $\nu = E/h$ and $\lambda = h/p$ in analogy with the Planck's similar equations for electromagnetic radiation. He called them "matter waves" since material particles exhibit their wave properties through them.

Because it was difficult to fix ideas about their physical nature, Max Born [5] considered them as "probability waves" which guide the moving particle. But Born's probabilistic interpretation could apply only to ensembles of large numbers of particles and could not explain the diffraction patterns produced by single individual particles and very low intensity light photons.

It is only now that a real physical significance is imparted to the de Broglie wave and Schrodinger wave function, and in fact to the Wave Mechanics. These energetic ripples in the sharmon medium, move tightly associated with the moving particle. The diffraction patterns for single particles are produced by Simple Harmonic variations in the phase and amplitude of these ripples. See detailed presentation in Ref. [2].

6. Special and General Relativity

The general covariance and invariance to Lorentz transformations of eqn. (3) of the Principle of Null Action follow from the fact that all terms in the expression for F in eqn. (3a) are canonically conjugate to parametric t, and subsequent operations of differentiation and integration are themselves so invariant. Eqn. (4) can therefore be taken over to the theories of Special and General Relativity. Einstein [6] has deduced the equations of General Relativity from Hamilton's Principle, which is operationally equivalent to the Principle of Null Action, as above.

7. Euler's Equations

When the expression for F contains q_k & q_{kr} but not q_r, $\partial F/\partial q_r = 0$, then, eqn. (4) reduces to the Euler's equations :

$$d/dq_r (\partial F/\partial q_{kr}) - \partial F/\partial q_k = 0.$$

8. Lagrange's Equations

In eqn. (4), let F be identified with Lagrangian L, q_r with time t, and q_k with x, $q_{kr} = dx/dt = x'$. If in addition, the expression for F or L does not explicitly contain t, $\partial F/\partial q_r = 0$. Then eqn. (4) leads to the Lagrange's equations:

$$d/dt (\partial L/\partial x') - \partial L/\partial x = 0.$$

9. Maxwell Equations for Electromagnetic Radiation

The electromagnetic waves propagate in the sharmon medium via contiguous mechanisms, the mediator bosonic "photon" comprising an aggregate of the sharmons [2].

An electric field E induces an electric dipole $p_e = lq$ with arm l and charge $\pm q$ in the sharmon packet comprising +ve positrinos and -ve negatrinos. Since the deforming force qE is equal to the restoring force $q^2/e_o l^2$, we have $q = l^2 e_o E$, $p_e = l^3 e_o E$.

The l^3 in the p_e expression becomes the polarizability of the sharmon packet. The displacement charge per unit area of the sharmon packet is nearly $D = q/l^2 = e_o E$. And the displacement current density in the sharmon medium is $I = dD/dt = e_o dE/dt$.

Since this displacement current in the real sharmon medium is real and solenoidal, it gives rise to a real magnetic field H, so that

$$\text{curl } H = dD/dt = e_o dE/dt \ ,$$
$$\text{div } dD/dt = 0 = \text{div } I.$$

The other two Maxwell equations for the sharmon medium are

$$\text{div } H = 0,$$
$$\text{curl } E = -\mu_o \, dH/dt.$$

Maxwell did not question the 19th century views about vacuum as an "empty space". Therefore his displacement charge & displacement current and hence the electromagnetic waves were only mathematical constructs and exigencies. They all now acquire real physical significance in the context of the omnipresent sharmon medium filling all space.

10. Newton's laws of motion

For an isolated moving particle far removed from other influences, F identifies with its kinetic energy T, q_k with t, and q_r with x. Then equation (4), on using $dx/dt = x'$, gives

$$x' \, d/dt(\partial T/\partial x') = \partial T/\partial t$$

where $\partial T/\partial x'$ is the linear momentum.

For the particle starting from rest under the action of a constant force P, T equals the work done by P in moving the particle a distance x, or T = Px whose partial differentiation with time t gives

$$\partial T/\partial t = Px'.$$

This with eqn (4) gives on division by x', the Newton's Second Law of Motion

$$d/dt (\partial T/\partial x') = P.$$

The Newton's first and third laws of motion are derivable from the second law.

11. A Thermodynamic Equation of State

For a thermodynamic system, the F identifies with the Gibbs thermodynamic potential at constant pressure, F = (H - TS), where H = E + PV is the total heat content and S is the entropy; E is the internal energy, P the pressure and V the volume. Here the expression for F does not explicitly contain the mutual derivatives q_{kr}. Therefore, in eqn. 16.7, $d/d_{qr} (\partial F/\partial q_{kr}) = 0$.

Identifying q_k with V and q_r with T, eqn 16.7 gives

$$[(\partial H/\partial T)_V - T(\partial S/\partial T)_V](\partial T/\partial V)_P + (\partial H/\partial V)_T - T(\partial S/\partial V)_T = 0.$$

Since $C_v = (\partial H/\partial T)_V = T(\partial S/\partial T)_V$, the above eqn. reduces to

$$(\partial H/\partial V)_T - T(\partial S/\partial V)_T = 0.$$

Differentiation of H = E + PV with V at constant P gives

$$(\partial H/\partial V)_T = (\partial E/\partial V)_T + P.$$

It can also be shown that $(\partial S/\partial V)_T = (\partial P/\partial T)_V$. The last 3 eqns. give

$$(\partial E/\partial V)_T = T (\partial P/\partial T)_V - P.$$

This thermodynamical equation is applicable to all states of matter.

12. **Discharge of Capacitance through Inductance & Resistance**

 If I is the instantaneous current in the circuit having capacitance C, inductance M, resistance R, and q the charge on C,

$$\delta F = \delta \int RI\ dt\ +\ \delta \int MI\ dI\ -\ \delta \int q/C\ dq.$$

 Three terms on the right are instantaneous energies of R, M, C.
In eqns. (4), identifying q_k with q, q_r with t, q_{kr} with I = dq/dt, we have

$$Id/dt\ (\ \partial F/\partial I\ )\ -\ I(\ \partial F/\partial q\ )\ =\ \partial F/\partial t.$$

 The above two equations with

$$\partial F/\partial I = \int 2RI\ dt\ +\ \int MI, \text{ etc lead to}$$

$$RI + MdI/dt + q/C = M\ d^2q/dt^2 + Rdq/dt + q/C = 0$$

the well known differential equation for this case.

Summing up remarks

 The above deductions of established working equations in diverse phenomena and varied fields of Physics illustrate the universal versatility of the Unified Theory's new Principle of Null Action.

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