Particles as localized self-looped oscillations of the space: Resolving wave-particle duality for particle beam superposition

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1. Preamble: Over the last few centuries, our knowledge, about the micro universe of elementary particles and that of the macro universe of innumerable galaxies, has advanced enormously. The successes have been dominantly achieved through the application of Measurable Data Modeling Epistemology (MDM-E). Unfortunately, advancement in the fundamental physics has remained stagnant for quite a few decades. Accordingly, we propose the iterative application of the Interaction Process Mapping Epistemology (IPM-E) over and above the MDM-E. IPM-E is akin to system engineering thinking; which has been at the root of rapid human evolution through innovations of tools and technologies. It is the act of visualization and iterative refinement of the invisible, but ontological interaction processes that nature is continuously using [1].

2. Space as a Complex Tension Field (CTF) and particles as its self-looped oscillation: All major successful theories of physics have directly or indirectly implied vacuum (space) as some form of Complex Tension Field (CTF) rather than being empty. As per IPM-E, let us accept the proposed CTF as physically real field (old ether) with a more descriptive name. EM waves, a linear excitation of the CTF, can cross the entire cosmic space with an uniquely enormous velocity, $c = (\varepsilon_0^{-1} / \mu_0)^{1/2}$, determined by the activate-able built-in electric and magnetic tensions. The linear excitation of a tension field is perpetually pushed away by the tension field to restore its local state of equilibrium. Based upon the fine-structure constant for particles, $\alpha = (e^2 / 2h)(\varepsilon_0^{-1}\mu_0)^{-1/2}$, we are postulating that this same CTF also possess the property of activate-able charge-tension e when some form of non-linear high energy perturbation $h({}_{in}f)$ succeeds in generating an EM wave that is a doughnut-like self-looped, and hence a self-resonant oscillation ${}_{in}f$ of the CTF. These self-looped oscillations of the CTF are also capable of imparting many novel "particle-like" properties around it in the CTF. Note that CTF itself is not moving; various excited gradients are oscillating. Linear excitations of the CTF perpetually propagate out while spreading diffractively. In contrast, the non-linear excitation generates perpetually propagating movement of the CTF gradient; but it is forever self-looped. When a self-loop oscillation is perfectly in phase with itself; it does not suffer from diffractive spearing like the linear excitations do. The internal self-looped frequency of an electron at rest is $h({}_{in}^{el}f) = {}_{0}^{el}mc^2$; and that for a proton is $h({}_{in}^{ptn}f) = {}_{0}^{ptn}mc^2$. These internal frequencies are uniquely defined and fixed for each particle. Particles are neither propagating waves; nor are they guided by some "Pilot Waves".

We further postulate that the self-looped oscillations of particles also generate various secondary properties as potential gradients around them of different spatial ranges. These gradients are effectively the various forces. When a particular type of long-range gradient makes a particle fall into, or get repelled by, the potential gradient of another particle; it acquires kinetic motion. The corresponding un-quantized kinetic energy (translation) requires another "external" oscillation, ${}^{k}E = p^2 / 2m = h\,({}_{ex}^{k}f)$. When particles exchange kinetic energy, they stimulate each other through this phase sensitive frequency ${}_{ex}^{k}f$. We may call it de Broglie frequency. There are no de Broglie waves. Because, when the particle is at rest; its external oscillation frequency is simply zero, rather than having a non-causal, infinitely long wavelength, $\lambda = h / p = h / m\text{v}$.

3. **Removing wave-particle duality from superposition effects due to multiple particle beams on a detector:** As depicted in Fig.1, mono-energetic particles with velocity v and corresponding kinetic frequency ${}_{ex}^{k}f$, arrive at location P in the detectors surface with distinctly two different phase information, $\exp[i2\pi({}_{ex}^{k}f)t]$ and $\exp[i2\pi({}_{ex}^{k}f)(t+\tau)]$, due to their distinctly different propagation path dely. If χ is the linear response

characteristic of the detecting molecules and the same molecule (or their assembly) experience two stimulations, $\psi_{1,2} = \chi \exp[i2\pi({}^{k}_{ex} f)t_{1,2}]$, then the spatial distribution of energy transfer and consequent transformation experienced (fringes registered) by the detector would be given by:

$$D(\tau) = \left|\chi\psi_1 + \chi\psi_2\right|^2 = \left|\chi e^{i2\pi {}^{k}_{ex} ft} + \chi e^{i2\pi {}^{k}_{ex} f(t+\tau)}\right|^2 = 2\chi^2[1 + \cos 2\pi({}^{k}_{ex} f)\tau] \qquad (1)$$

The absorbed energy comes from both the stimulating particles $\psi_{1,2} = \chi \exp[i2\pi {}^{k}_{ex} ft_{1,2}]$; QM formalism of Eq.1 clearly implicates this. Trajectories of the individual particles are not mysteriously re-directed by some unknown force to create the fringes. The two different stimulating phases are two causal signals brought by two real particles

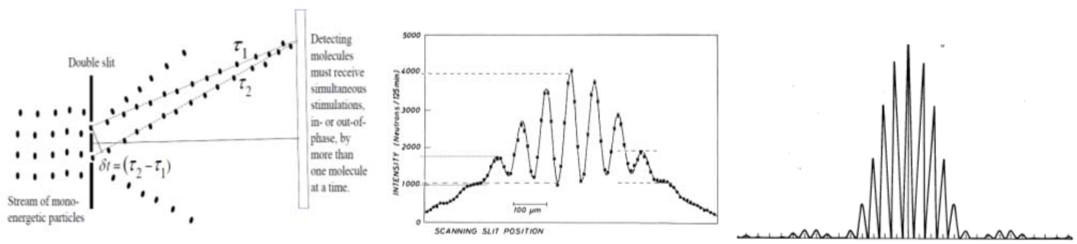

Figure1 [1]. ***Left:*** Particles from a mono-energetic particle beam separately passes through two slits and arrive with different kinetic phases on the detection screen. ***Middle:*** Experimentally recorded low contrast fringes [2] for a neutron beam. Right: Very high visibility optical fringes; which is not achievable by particle beams.

arriving simultaneously to stimulate the same detecting molecule at P. They have travelled different distances, $\tau = (r_2 - r_1)/\mathrm{v}$, where r_2 and r_1 are two distances to the same detector at the point P from the two slits.

If our postulate is correct that phase sensitive superposition effect generated by particle beams is due to particles acquiring harmonic oscillation ${}^{k}_{ex} f$ due to velocity v, then it may not be impossible to generate same kind of superposition fringes by sending two different kinds of particle beams having the identical kinetic frequency through the two slits. Then the detecting particle will experience two distinctly different and causal *amplitude stimulations* $\chi_{1,2} \exp[i2\pi({}^{k}_{ex} f)t_{1,2}]$ and absorb energy accordingly producing fringes of visibility less than that one can get using same kind of particle. This would clearly establish that the postulate, *single-particle-interference*, is not a causality-congruent hypothesis. We should underscore again that ***the detecting molecule must be a resonant energy absorber, which first experiences amplitude-amplitude stimulation and then extracts energy from all the stimulating fields*** (particles). This, of course, is already built into Eq.1; which is mathematically similar to light-detector stimulation.

Another way to validate our proposed explanation for superposition effect due to particle beams would be as follows. Assume we are using a mono-energetic beam of Rb atoms through a two-slit system. The far-field detection plane contains a thick high-resolution photographic plate (Ag-Halide). The arrangement is such that the development of the photographic plate will show black and white fringes as predicted. The next question is as follows. Are the bright lines (the zeros of the fringe pattern in the photographic negative) completely free of Rb atoms? We suggest that this plate be illuminated by 780nm laser beam to generate resonant fluorescent spontaneous emission which can be recorded as a one-to-one quantitative image. Our prediction is that the distribution of Rb fluorescent intensity will resemble approximately the superposition of two slightly displaced Gaussian beams as classical *bullet* theory would predict. These experimental observations will clearly remove the necessity of elevating our past ignorance (duality) as the new knowledge!

[1] C. Roychoudhuri, Ch.11 in [Causal Physics; Photon Model by Non-Interaction of Waves], CRC Press, 2014.
[2] A. Zeilinger et al., Rev. Mod. Phys. **60** (4), 1067 (1988), "Single- and double-slit diffraction of neutrons".