Prolegomena to Any Future Formal Derivation of the Full de Broglie-Bohm Theory of Quantum Mechanics
or
Ode to a Swiss Patent Clerk

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Abstract

The mistake in thinking that lies at the very heart of modern physics is the conflation of the categories of "flexible" *how-much-ness* (measure, distance, length, etc.) with "rigid" *how-many-ness* (number, count, quantity, etc.). We seek to initiate a discussion between the various academic disciplines in order to consider what may result when this issue is addressed in a deep and methodical kind of way.

1 A Restatement of the World Problematique

If Immanuel Kant is relevant to us for a single reason, it is for the reason that covert mistakes in the [categorical] form of our thought processes may occasionally sneak up on us and lead us to speak propositions that are demonstrably untrue.

A *measurement* always points directly to a singular, irreducible, ineffable aspect of our shared empirical reality. It means: pure presence, plain and simple. A *count* rather refers to some learned procedure that the primate brain may easily invoke in order to determine that property of some set of things called *quantity*. As such, it is a representation that is mediated by the particularly [all-too?] human faculties of sense perception and logical reasoning.

To speak of an "exact" measurement is in a deep sense to admit a patent falsehood. If we want to say something like *this stick is exactly one foot long*, we are really attempting to make the claim that the stick is some perfect value, namely 1.0000000... feet long, which just means that we have said a fundamentally impossible thing. There must always be a level of granularity at play, against which we perform rounding operations and state our working threshold of error. The thing we are really striving for is to be the least wrong in the measurement claims that we make.

Problems may arise once we use the same set of symbols to make representations of measurements and of counts. Therefore, being explicit about, and subsequently correcting the [categorical] mistake of conflating trains of thought in physical theories related to [essentially] true measure and [nominally] factual count, and then beginning an honest investigation vis-a-vis "where the math takes us" is the goal of the present essay.

2 The History

If the birth of modern quantum mechanical thinking must be pinned down to a precise historical moment, is must surely be when de Broglie developed and submitted his understanding of the wave-theoretic paradigm of ponderable matter. Schrödinger was quickly inspired by this vision and looked forthwith to Laplace's pointed investigations as guidance for the mathematical description of what we may loosely denote as *nice looking wavy things*, or NLWTs. This was the mid-1920s, however, and the "civilized" world was well on its way to a meeting with destiny. The state of the entity that Adam Smith long ago called *political œconomy* began to mandate that the collective human reasoning process be geared towards the investigation of the effective limits of what is now called particle physics. By its very nature, this pursuit is dedicated to extracting the highest amount of energy that nature is capable of offering. This turn of events required the movement of the theoretical mind towards collision-centric thought experiments and related theories.

(The following paragraph speaks in terms of the standard approach to quantum mechanics, which is inherently probabilistic in nature. Read it at your own peril!)

The invocation of "Born's rule" followed by a state-destroying "measurement" is the well established route through the bewildering intellectual landscape that we must now attempt to describe. We have to become aligned with the Heisenberg formulation, which thinks in terms of transcendental algebras operating over abstract containers like vectors and matrices, resulting in a rather bleak vision of physical process. In order to accommodate the compelling image of the NLWTs of de Broglie-Schrödinger glory, Dirac and von Neumann "conspired" by way of allowing the partial differential equation (PDE) that acquired Laplace's name to become hopelessly intertwined with the Heisenberg-Born camp by way of the fairly nebulous notions of "eigenfunctions" which utilize certain "eigenvalues" that by some ineffable mechanism must "act" upon a "space" of phases in order to confine the vexingly spread-out NLWT into a cell that turns it into a well-behaved, localized "result" which thankfully now is said to exist within our very own world of everyday experience and intuition. But this is no longer recognizable as proper mathematics! Regardless of the rigorously symbolic "look and feel" of the Dirac notation, we may henceforth simply call it a *strange looking mathy thing.* But such SLMTs do not rank highly among the class of statements that say things to the effect of:

- One and one make two
- Any two points may describe a circle
- Any three points that are not on a right line are the vertices of some triangle

3 The Math

I am thrilled at my newfound understanding of the deep significance of Laplace's equation,

$$\nabla^2 f = 0, \tag{1}$$

which lies at the very heart of every kind of physics that may rightfully be deemed "modern". I simply needed to understand the significance of the *nabla* (∇), and particularly how it is employed in constructing gradient vector fields from arbitrary scalar fields and then reducing the gradients into a profoundly meaningful value called *divergence.* The operator called the *Laplacian* (∇^2) simply says, *take this strange blob of numbers and then tell me to what extent it represents an abstract source or sink.* So for some function to satisfy Laplace's equation, its internal abstract sources and sinks must perfectly balance out.

My mathematical breakthrough happened yesterday when I stopped trying to think of Laplace's equation in terms of a system that changes over time (it is typically described by educators and popularizers in terms of flowing fluids), but rather as a singular space-filling object that is trying to whisper some kind of deeply significant mystical knowledge. When mathematicians are inevitably pulled towards framing their thinking wihin the auspices of clock time, and physical processes occurring therein, then it simply verges on the impossible when it comes to solving non-trivial questions that are posed in the language of PDEs. Non-trivial questions posed in the language of PDEs seem to be at their most non-trivial when they are posed in terms of three dimensional blobs.

A somewhat related case involving three dimensional blobs occurred in the early 2000's when Perelman satisfactorily solved the Poincare Conjecture. He required usage of Thurston's Geometrization Conjecture (which he turned into a proper theorem) and of Hamilton's Ricci Flow. His main procedure was to perform "surgical" operations on arbitrary simply-connected manifolds of the third dimension. He needed to use the metaphor of a ticking clock in order to rigorously demonstrate this highly creative technique. My [currently fuzzy] thinking about this case is that such a clock-centric approach to the question of how to characterize such geometrical entities is not strictly necessary once the full depth and breadth of purely Laplacian-style thinking has been unleashed.

4 The Physics

To develop a deeply intuitive and therefore immanently "understandable" approach to quantum mechanics, we must simply think in terms of spherically embedded volumes of [for want of a better term] *Laplace-stuff* that necessarily exist within a dimensional framework of some unknown curvature. To be sure, this curvature is a measure and *not* a count. If we were to make a positive claim that this particular measure is necessarily (or even probably) 0, we would entirely miss the basic principle that it simply *cannot be* the integral value that is famously known as *zero* (among other celebrated names), but it must rather be the real value that is exactly 0.0000000..., which is to say that, as noted above, we are necessarily wrong in the claim, and that we must at least give some effort to operating under the impression that another value could be more appropriate.

Given the works that are [hopefully] to come from your humble narrator, it should be fairly straightforward to prove that nothing like our own world can be derived from curvatures that first of all are not strictly positive. When the curvature is positive, the framework can be said to "complete" itself. This kind of completion is given to us by way of *one-point compactification*, aka *the Alexandroff extension*, which is the same thing as imagining a line becoming a circle or a plane becoming a sphere. Our goal is to be able to appreciate the fruits that flow to us when we can imagine a space curving in all directions back into itself, so that its entire bounding surface must become "crunched" into a perfectly massless singularity. And it is precisely in the vicinity of this wondrously singular location that our attention must be turned if we want to behold why a new kind of thinking is in order when in comes to improving our theoretical understanding of physical reality.

5 Enter Aristotle

Many of the theoretical entertainments result from considerations of a vanishingly small value for the curvature. The importance of this is simply that the universe consist of enough effectively empty space to accommodate the staggeringly vast array of material bodies that are necessary to enable the existence of arbitrarily detailed cosmic realms. Within these realms, planets may form, cool down, and then develop liquid oceans replete with jiggling microscopic creatures that may eventually stand upright on solid ground. It is hoped that those creatures will ultimately work together to hear the most vexing challenges that nature herself phenomenologically whispers into their ears. If they have the heart and mind to do so, they will begin to question as did the giant of natural philosophy himself. For,

> *Questioning is the piety of thought.*