Predictions for many worlds interpretation in quantized spacetime

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Abstract

It can be argued that Loop Quantum Gravity has successfully reformulated quantum mechanics using only an assumption about quantized spacetime and the Information Hypothesis. If the argument holds, LQG are effectively taking as an axiom that all matter and radiation, including the photon are fundamentally information systems existing and interacting on a quantized grid substrate. In this paper we examine how the consequences of such a shift in axiomatic foundation inevitably lead to a new heuristic model of light. The photons in this model are subject to constraints that manifest as properties of light that differ from classical photonics in important ways. If this predicted behaviour can be detected, it sheds ligt on the true nature of our universe. The Xyston prediction indicates

If undetected, this provides an avenue for constraining the parameters that allow the Information Hypothesis to be a viable way forward for a deeper understanding of quantum mechanics.

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1. The many worlds interpretation offer an alternative intuition to quantum entanglement
2. Provides succint explanations to some of the strangest phenomenons in quantum mechanics
3. Wave particle duality, double slit experiment and quantum entanglement.
4. Xyston argument presents a way to make specific predictions about light behaviour under a specific interpretation of quantum mechanics.
5. The interpretation requires many worlds (to explain entanglement, all quantum observer effects, double slit experiment), the information hypothesis and a local hidden variable theory of quantum mechanics.
6. If the predictions are supported by data from telescopes, this is a strong indication that the many worlds hypthesis is correct, because a strong indication of a precision cap on the directional freedrom of light would suggest that quantum indeterminancy cannot be fundamental to information propagation

Introduction

An approach to Quantum Gravity has been to continue on the path pioneered by Max Planck, assuming the quantized nature of reality. A notable success in this field is the work by Carlo Rovelli and his team and the reformulation of Quantum Mechanics on a grid like subtrate in their Theory of Loop Quantum Gravity. A reformulation of an existing theory is a powerful move, because it suggests that all the successes of ordinary quantum theory could have been realized through such a grid and information based approach, had the time of discovery of these different formulations of the same underlying reality been reversed. The success in reformulating quantum mechanics by quantizing spacetime and implementing all particles as features of the information state of this grid might be revealing a deeper, more fundamental question.

Loop Quantum Gravity uses a model where quantum interactions are understood as the interaction between open and closed loops, that move around on quantized positions on spacetime. It can be argued that Loop Quantum Gravity through this model of quantum fundamentals rests on an axiomatic foundation where everything is quantized, including the substrate of spacetime itself. This has important implications, because it implies that the Information Hypothesis is also part of the axiomatic foundation. A consequence of this is that we implicitly cast every particle that exist as an information pattern encoded on this n-dimensional lattice. The space of possible configurations of reality is inherently also quantized, governed by the number of orientations that the grid can support, the amount of information implicated etc. For example, quantization of position, direction, speed, energy levels and momentum might be nothing more than tell tale signs of the quantizedness of spacetime itself. This quantised legacy might in turn leave fingerprints about the constraints these information system operate under in real world observations. If such fingerprints can be detected, we do more than increase our understanding of the universe, we can revolutionize the philosophical foundations of quantum mechanics. To see this argument, it's important to understand the significance of the Loop Quantum Gravity reformulation of Quantum Mechanics.

0.1 Deterministic Evolutionary Emergence Process (DERP)

It isn't surprising that a reformulation of a theory is possible. But each reformulation brings with it an unique axiomatic foundation. The benefit of reformulations is to simplify relationships and to explore various ways of expressing the theory through different axiomatic ground rules. With Loop Quantum Gravity, the axiomatic foundations are radically simplified, using only

1. Grid or lattice network (space-time)
2. Information (duality)
3. Evolution (process)
4. Emergence (survival from interactions)

Patterns of information states are encoded by the means of binary logic (duality), which is predicated only on an abstract substrate, such as a grid or a network. Time can be seen as the relationship between information states on this grid, which may be direction agnostic. But if the evolution leads to an increase in entropy, there is an overall direction of time allowing for the definition of an arrow of time. The remaining complexity of our reality can be seen as emergent phenomena from this information undergoing evolution, selection and interaction. This begs the question, why does a reformulation under such minimalist assumptions work?

There are two possible answers:

1. The reformulation was possible due to the inherent flexibility on how to formalize any self-consistent algebra. Under this interpretation, a grid is a sufficiently flexible system to implement any algebra, and the fact that it works on Quantum Mechanics does not necessarily imply anything about the true nature of our universe.
2. The phenomena of quantization observed in quantum mechanics, and by extension in the real world, is inherited from a reality where spacetime is quantized. Such a reality would conforms to the DERP axiomatic foundation. This has the potential for intuitively explaining why quantization occurs and take so many forms.

It's obvious that discerning between these two possible answers would provide us with deep insights either way. But if the second answer is true, the consequences would far exceed the obvious - to elevate the Loop Quantum Gravity formulation of Quantum Mechanics to canonical status. It would reach much deeper, and open up opportunities to probing quantum mechanics at a deeper level than particle physics, through an entirely new field studying the foundational interactions that give rise to the forces of the universe. In this paper we intend to make a the first foray into this world of DERP Quantum Theory.

0.2 Cellular automata as a working model

Cellular automata such as Conways Game of Life can be used to imagine the problem information systems.

0.3 The pesky problem of free directional movement

Imagine a photon being emitted from a sun, far away. We have learned that the photon is both a wave (before being observed) and a particle (when observed) , and travels as a wave through something which we don't understand, but know how to work with abstractly as the electromagnetic field. Experiments such as the double slit experiment show that the act of observation, fixes the photon to a specific location, but other than that it moves as a wave.

When trying to implement this model of light as a Process of Information Evolution (PIE), we run into some thorny issues to explain:

1. The wave / particle duality
2. Superposition
3. Entanglement
4. Speed of light

This paper will not go into details about the first three, this must be done for the purposes of brevity. Suffice to say that each of these can be understood in the context of a general theory of mind. The fourth relates to the photon travelling at the speed of light, when in a vacuum.

The expected photon count for a detector of radius d, placed at a distance d from an Emitter, when the Emitter emits only into one quadrant.

$$\tau_c = \frac{2r}{\frac{d\pi}{2}} E$$