The Quantum Pendulum Clock is Infinitely Precise

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Part 1

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For some time, I have been claiming that quantum mechanics (QM) should not be regarded as a *theory* for the *dynamical properties and interactions* of physical objects,

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regardless whether we talk of particles, atoms, molecules, and such, or fields describing Yang-Mills interactions or space-time curvature etc.

Rather, QM must be considered, explained and interpreted as, a *language* for describing these dynamical features. It is all about information. As long as we have no good idea concerning the absolute laws of Nature, one theory is as good as an other, and therefore,

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What I suggest implies that absolute laws of nature exist, and an absolutely precise language must exist also, but we have not found them, we are not even close, and this is my explanation as to why QM generates rather bizarre explanations as to what a particular quantum mechanical model "actually says about reality".

If a theory is quantum mechanical, it cannot predict many kinds of events accurately, it merely generates statistical data, and our theory is considered to be successful if these data look similar to the statistical data obtained from experiments.

As long as our descriptions, or 'predictions' yield statistical distributions, we know that our theory is obviously wanting. Superpositions of realities are absurd ways to describe our world. As long as we are happy with such descriptions, we could abstain from any further attempts to improve them, but in my opinion that is a surrender. Nature will always be too difficult to understand. Is that true? Why should it?

In other branches of science, to which also fundamental physics used to belong, it is totally natural to assume that ultimate and accurate descriptions of the world we live in, exist, but very often our prediction of future events will be statistical, and in most cases that is as far as 'modern science' will ever get.

Maybe, but I don't believe, that if *the initial state would be exactly given,* the final state will still have to be statistical.
QM is just a language, and what we should be doing as scientists is seek for ways to improve that language. We should obviously continue our attempts to find the ultimate laws. I am sure they are there, waiting for us to discover them.

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Now I can use QM language for this:
Its Hamiltonian is $H = \omega p$. If the gear has N teeth, so that the position x is discrete, it can be in N states.

We consider the states $|x\rangle$, with $x = 2\pi n/N$.
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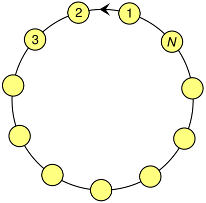
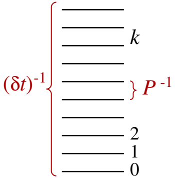


The limit $N \to \infty$ is usually easy to take.



Experimenters living in this world find quantum expressions to describe its motion. They consider the energy states $|n\rangle$ with energies E_n .

They define operators a and $a^\dagger$: $a|n\rangle \equiv \sqrt{n}\,|n-1\rangle$,

so that, in the limit $N \to \infty$ $[a, a^\dagger] = 1$, and define

$$x = \frac{1}{\sqrt{2}}(a + a^\dagger)\ , \quad p = \frac{1}{i\sqrt{2}}(a^\dagger - a)\ , \quad [x, p] = i\ , \quad H = \frac{1}{2}(x^2 + p^2).$$

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They conclude that it is a

quantum harmonic oscillator:

Since it contains rotating gears *and* an oscillating pendulum, I call it a

quantum pendulum clock.

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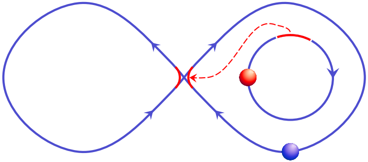
YES !

Take a multitude of gears, and add switches.

Gears are bosons, switches are fermions.



These two degrees of freedom interact.

Most important distinction between our "Infinitely Precise Quantum Theory" (IPQT) and the more familiar quantum models such as the SM:

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  - Therefore, the mathematics for the IPQT will be exactly as in any other quantum model.
- But the physical interpretation is philosophically much more acceptable.
- The IPQT is more restricted. To be precise, *time* must be expressed in integer units.
- To me it seems obvious that we should continue to search for the correct IPQT, to describe the phenomena we see in nature.

There are three different types of theories that we can use to describe observed phenomena:

- Totally classical descriptions, which describe all physical data that can be measured in terms of properties that can be measured, in principle with vanishing error bars. One never observes superpositions of real states (Schrödinger cats)
  Example: Kepler's planets, which may interact.
- Conventional quantum theories. Quantum superpositions cannot be distinguished from 'real' phenomena,
  Example: The Standard Model.
- Theories that allow a classical description, but also, by use of transformations in Hilbert space, allow a quantum mechanical description.
  Example: the pendulum clock: a particle moving in a circle, which allows a *transformation* to an harmonic oscillator.

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In principle, any model can be modified by a very small amount, to recognise a classical underlying structure.

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Actually, General Relativity may gives us clues. GR forces a constraint in the amount of information in and near black holes, which may perhaps indicate that we should find deterministic models near the Planck scale.

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These ideas about the meaning of quantum mechanics actually raise a prediction:

Quantum computers will not be any better than classical ones – *if scaled towards the Planck scale.*

They should be worse, since the outcomes of 'quantum calculations' will be superpositions of answers, while only one answer can be the desired correct one.

End of Part I