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The Future of our Science

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According to N.G. van Kampen, the history books of the future will recount:

“The scientific period lasted from 1500 to 2000”

People today are so spoiled by the enormous achievements of the science and technology of the past, that they are no longer interested in supporting our attempts to make further progress. They cannot follow anymore what we are discovering, and it does not seem to make any difference. What some people call “science” today is often a mockery of the real thing . . .

Cars, airplanes, telephones, laptops are taken for granted. Emotionally, many people still live in the middle ages, or worse, only like monkeys in the stone age.

Our brains are not yet adapted to the scientific methods of reasoning. Wars, terrorism, political dictatorships, are still inspired by primitive, medieval religions.
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Except one: We learned how to use correctly all equations of quantum mechanics, but we still have not understood what these equations say about reality.

Our equations tell us that, when a quantum experiment is done, the outcome is to be expressed in terms of probabilities. These probabilities can be calculated by computing amplitudes and taking their absolute squares. This does not mean that there the world splits up in “many worlds” (a separate universe for any outcome of the experiment)

It should be obvious that today’s science is incapable of predicting with certainty what will happen in a quantum experiment, and that this lack of understanding should not be shrouded by a ‘many world’ mysticism.
We must realise that homo sapiens evolved less than a million years ago from more primitive primates like gorillas and chimpanzees.

We had monkey brains then.

These brains were selected for being able to jump from tree to tree, for finding food, and for social interactions, such as fighting with, or copulating with, other monkeys.

That logic wasn't good enough for science. Did they wonder why ripples in a pond emerge when you throw a stone in it?
To be able to jump from tree to tree, we had to understand distances. End 16th century, the Dutch scientist Simon Stevin invented the decimal notation.

Humanity discovered the usefulness of real numbers for science. Today, they forgot that real numbers are a man-made invention, and they might not be the most elementary framework for fundamental physics.

We must remember that real numbers, Hilbert space, string theory, etc., are man-made abstractions that may or may not deserve an elementary place in fundamental science. Today, we use them because we do not have anything better.
To explain how I expect future science to look, I use the following metaphor

(But I am also equipped with the brain of a recently evolved monkey . . . ) :
Imagine you were God

Your assignment:
Imagine you were God

Your assignment:  
Run a Universe
Imagine you were God

Your assignment: Run a Universe containing billions of stars, planets, life forms, elementary particles

How do you order the movements of each of them?

How do you run the administration?

Install Laws of Nature!

How do you choose those?

That is not so easy!

Example: cellular automaton
Before deciding about the rules (Laws of Nature), first:

Demand #1: Our rules must be unambiguous.

Q: Really? What about quantum mechanics?

Demand #2: We must have causality. Cause always comes before effect. This means that we need the concept of time. Our laws should never be circular!

Demand #3: The rules must be efficient. God’s laptop should be able to implement the rules. The calculations should not be more complicated than strictly necessary.
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Impose demands that your laws should obey

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Here, I try to do just that.

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**Demand #3:** The rules must be *efficient*

God’s laptop should be able to implement the rules. The calculations should not be more complicated than strictly necessary.
From here, we arrive at some very general *rules* (laws of physics):

**Rule #1:** We have *locality*

What happens at one spot of the universe, only depends on the situation in its immediate vicinity.

**Rule #2:** Something that *moves* on a straight line, must obey the same rules as when at rest.

This is not trivial at all!

**Rule #3:** But there is a *speed limit*

This, unfortunately, is necessary. If something moves with (almost) infinite velocity, we would not be able to adhere to rule #1, locality!
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*and now there are problems...*
If a stationary object has moving parts, the object may obey the speed limit, but do the moving parts?

Amendments are required:

Rule #3a: Things that go very fast, must have time going slower. If something moves very fast, its internal components should move slower!

Rule #3b: Something moving very fast, will contract in the forward direction. And that's also not quite enough . . .

Rule #3c: Inside things that move fast, clocks will not go synchronously. This leads to special relativity, which is almost indispensable in a smoothly running universe.
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Problem with continuity (real numbers): Given a piece of matter, can we slice that up into smaller pieces of matter ad infinitum? Is there a quantum of matter? (atom) If not, infinite amounts of calculation would be required, a clash with demand #3 (efficiency). Therefore, there must be Rule #4:

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**Rule #5:** Forces

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**Rule #6:** Fix the initial state
Choose it as simple as possible
Now, combine all these rules into one comprehensible set of laws.

Note: humanity needed almost 50 years to combine rule #3 (special relativity) and rule #4 (quantum mechanics); we still haven’t succeeded to add to this rule #5 ("quantum gravity").
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Demand #4: The universe must emerge as sufficiently complex
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If AI indeed takes over our baboon thinking, it might require an initiative comparable to the Manhattan Project: run a super-democratic government by computerised minds – beware of hackers! The system must protect itself . . . ,

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If AI indeed takes over our baboon thinking, it might require an initiative comparable to the *Manhattan Project:*
run a super-democratic government by computerised minds – *beware of hackers! The system must protect itself* . . . ,

while there must be a **safety exit** button . . .
THANK YOU