Where is the machinery in Physics?
What is doing what how and why?

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Abstract

The description of nature is done with the help of mathematics and concepts that give physical meaning to the mathematics. The concepts relate objects and processes through mechanisms. A special kind of mechanism is machinery. Current physics holds not enough machinery. What is the machinery for the Newtonian gravitational pull for instance? There is no machinery giving us a reason. What is doing what how and why? In this document the mechanisms and machinery or lack thereof of some current existing theories (Quantum Field Theory and General Relativity are amongst them) are discussed briefly. We should aspire to make the next step in physics and describe nature through machinery so a working model of reality can be build that behaves like reality. Principles and laws are no machinery. They are inferred from machinery. Any mechanism that is not machinery can not be used. The machine needs to work.

1   Mechanisms

Mechanism: process, technique or system for achieving a result/description
Machinery (specialisation of a mechanism): the working parts, the arrangement of objects and their properties (structural and interaction properties), that make up the system/device/reality.
Material: physical form, the fabric of the machinery.

It is not enough to describe the behaviour of a system. You need to explain the behaviour and you need to make that explanation understandable and trustworthy by showing that the explanation works through its understandable and trustworthy machinery. The description is in the mathematics, the explanation in the concepts/the physics/the story/the pictures, the machinery and the material(s).

An example of a completely machinery driven explanation for our physics is in [1]. Another example is given by Pierre Millette [2]. Almost all of Millette's physics is machinery driven. It seems only missing in the tearing and gluing of the fabric of spacetime and in the combining of space and time into spacetime. The argument that measurement results infer that something must

be the case is to be used with caution. The interpretation of the bleeps and flashes is probably not done free from trust in existing conclusions from the past and our common beliefs in specific theories. As an example the current interpretation of the measured redshifts in spectra from out of space is that the expansion of our universe is going at an ever accelerating rate. This conclusion is drawn without machinery for (for example) the constitution of elementary particles or the constancy of the speed of light. Machinery might allow for different interpretations that do not need accelerated expansion (see [1]). In the case of spacetime the machinery of reality may only need a separate space and time description and at the same time facilitate the necessity for humans to describe reality using the concept of spacetime from the human reductionist perspective. In other words we need spacetime to describe the behaviour of objects as long as we model objects (as separate from their surroundings) while at the same time reality might be one fabric (one object) without any separate objects.

As humans we should also realise that in the past we have never been right about anything in describing reality. All we did is construct seemingly better and better approximations. Believes in our ability to describe continuity, and different types of infinities may be on a par with our believes in a deity. Working without machinery holds the risk of physicists becoming the high priests of their own very complex religion in too many dimensions and too many universes before, after or beyond too many beginnings, ends and borders.

1.1   General Relativity

In general relativity (GR) the two relevant objects are spacetime and energy. Spacetime has 4 dimensions, a form and sometimes the property of elasticity is also attributed to produce the machinery to reshape the form. GR has no machinery for describing energy and its relation to and influence on spacetime. One can not answer the question what energy is (made of) nor why it shapes spacetime, only how it shapes spacetime (almost everywhere). The reason why energy moves the way it does in curved spacetime is a mechanism (principles such as parallel transport and geodesics implemented in mathematics) but not machinery coupling to machinery. In the Einstein equations of motion the energy tensor is a geometrised representation of the participating energy to put energy mathematically on the same footing as spacetime so the equivalence sign can be used. The energy is just 16 numbers in a 4 by 4 tensor, suited for comparison with the shape of the metric tensor for 4D spacetime, but the energy is not a material/fabric itself and has no shape (other than being a 4 by 4 tensor).

1.2   Quantum Field Theory

In Quantum Field Theory (QFT) the (two) relevant objects are spacetime and fields. No machinery is given for how spacetime and the fields interact or how the fields get into the spacetime. What generates the fields? No machinery is given for how or why the probability field is changed, only mechanisms for how it is changing in the form of principles and mathematical rules. Don't ask why or how, just calculate. Any interpretation is debatable and no consensus is reached on the interpretation. In [1] it is argued that there is no need for an interpretation because QFT is itself an interpretation and this concurs with the "shut up and calculate" that is frequently heard.

1.3 String theory

In String theory the relevant objects are spacetime, strings and fields. Strings have more than zero dimensions and the property of vibration in string-fabric. Spacetime has more than 4 dimensions. The property of super-symmetry is claimed to be required. No machinery is underlying the interaction between spacetime and strings/branes nor the interactions between strings. No machinery is given for statistical behaviour.

1.4 Information theoretical descriptions (such as emerging gravity)

In Information theoretical descriptions, where the objects are bits and dimensions (and spacetime and other objects emerge from bits and dimensions), no machinery is present at all. Some mechanism seems present. Information theory can always be used as a tool to describe behaviour of systems or whatever is turning up in reality or experiments. That is what statistics is born to do. Bits don't interact. Statistics doesn't explain anything. It just describes behaviour and form. How much information is handed to you or represented is determined by a probability distribution and is expressed in for instance bits. To make sense of bits an additional interpreting schema is needed, for instance in the form of a computational device. QFT is in a way (spacetime doesn't emerge but is part of the description) also such a description because of its probabilistic nature.

1.5 Quantised spacetime theories

Whenever spacetime is being quantised, questions should be answered such as what are the properties of a quantum of spacetime. How does the quantum couple to its neighbours, how does it let go and how does it stretch or if it doesn't how does stretch come about macroscopically. What is in between quanta and what are the properties of the in between? Important in this light seems to be the work of N.J. Wildberger (professor of mathematics, university of New South Wales, Australia, see for instance youtube.com and [3]) on the foundations of mathematics and the mathematical problems with describing continuity.

1.6 Merging two models into one

Considering two models as potential candidates for unifying is a dangerous mission. Each model will have its strengths and weaknesses. We want to keep the strengths and get rid of the weaknesses. Physicists consider GR and QFT to be candidate models for unification. It takes great ingenuity to accomplish such an endeavour (especially if it cannot be done). It brings new insights and directions. It also takes manpower that might be needed elsewhere. It seems a good thing to attempt to unify GR and QF because it brings us string theory and loop quantum gravity and other ideas. At the same time an analyses should be considered that states that GR and QFT cannot be unified because the objects that represent energy in both theories are too different. Both theories use spacetime. QFT considers a probability distribution for describing a system of energy and puts this in spacetime without specifying the interaction of this coupling to spacetime. GR uses a set of numbers for representing energy and movement in a tensor format to geometrise the

object to be able to make it interact with spacetime even though the conceptual description of how the two merge and what the geometry of energy is is lacking (other than it being a simple 4 by 4 tensor that doesn't describe the symmetries of particle physics.). In representing energy QFT and GR conceptually have nothing in common other than maybe the word field. I think we need a description based on only machinery from which GR and QFT can be inferred as human perspectives.

References

[1] The properties of space, Bas van Stekelenburg, 2014, destekel.nl

[2] Dislocations in the spacetime continuum: Framework for quantum physics, Pierre A. Millette, Progress in physics Vol. 11, 2015

[3] Divine proportions. rational trigonometry to universal geometry, Norman J. Wildberger, ISBN 0-9757492-0-X