How could science be different?

The Expansion of Physics
by Deconstruction of Metaphysics

I. EXPANSION OF PHYSICS

The brief remarks justifying the announcement of the essay competition reveal an uncertainty about the nature and value of natural science. Not only critics of natural science, but also natural scientists themselves have come to doubt natural science.

Doubt and criticism are of course nothing bad and always possible. But one can also accept the challenge! Because contrary to all negative expectations, the age of natural science is just beginning. One must not be irritated by the lack of imagination and the lack of visions of the future of the late enlightenment thinkers who set the tone today. Natural scientific thinking is not part of the problem, but the way out of the situation that seems difficult today. Just as humanism in its time challenged the religious age, but only after difficult crises and struggles resulted in a victorious Enlightenment, so natural science for its part poses increasing challenges to the Enlightenment. It is to be hoped that a new, brilliant age inspired by natural science will unfold after the Enlightenment. Postmodernism, for all its acute contradictions, is running toward a dominant natural science whose orthodox core is physical thinking. This belief (sic!) in a great future of physical natural science, advocated here, must be justified in what follows.

First of all, a clarification is important: It is wrong to say that enlightenment and physical thinking belong together. It is true that physical thinking has indeed developed in the shadow and protection of the Enlightenment in order to be able to stand against the religious furor. But actually religion and enlightenment are closely related, while physical thinking is fundamentally different. With religion as with enlightenment, human thinking makes the decision about what is true. With religions one thinks of a higher instance, the divine, into which the decisions about what is true are projected. The great merit of the Enlightenment was to destroy this construct and to allow criticism in general, especially of the imagined authorities of religion. Under the

KANTian slogan of liberation from self-chosen immaturity, the divine was deleted, and the decision about what was true could now take place directly in the thinking of every human being. This self-awareness has given Western, enlightened society a special, very positive development boost. Since then, however, a great deal of effort has had to be made to mediate between the many individual truths to which the individual refers by virtue of his freedom of critical thinking. Whereas in the early Enlightenment freedom of thought was used to finally be able to decide the truth by rational thinking, in today's late Enlightenment every thinking and feeling is equally admitted as true. What the individual wants should be true.

Physical thinking has benefited greatly from this freedom to criticize, which was brought about by the Enlightenment. But from the beginning physics was a completely different concept. In physics namely not the human thinking makes the decision about the truth - also not the reasonable thinking - but the reality. It is only incumbent on the human thinking to enable the decision by the reality by means of a suitable question in each case. This happens by means of models, for example the experiment as model of the reality and the corresponding theory. Similarly as the dethronement of the divine by the Enlightenment led to an angry, aggrieved reaction of the religious dignitaries, so today the partisans of enlightened reason react aggressively if their imagined metaphysical cognitive ability is to be reduced to a supposedly trivial comparison with reality.

The current problem of the natural sciences is that they are intimidated by the helpless alarm of the late enlighteners and do not regularly insist on a physical comparison with reality. Because then the range of validity of the physical thinking would be extended strongly, what annoys the philosophers and frightens many natural scientists themselves. But there is up to now no proof that anything in our world could stand outside of the reality and would be withdrawn with it from a physical provability. Also there is no proof so far that truth cannot be defined exclusively by reality. The metaphysics argues here only with invalid conclusions by analogy. In this respect, physical thinking has many good reasons to give up the previous narrow external as well as self-limitation of its horizon of knowledge and to expand. Such an expansive renewal of natural science frightens many. But one has always been afraid of natural science, but then it has convinced again and again by its fascinating results in the knowledge of truth.

II. DECONSTRUCTION OF METAPHYSICS

PLATO's obsession that there is a second world of idea beside the reality, in his words the world of form, has not been proved until today. Although already the rather proto-scientific ARISTOTLE devalued this idea of his teacher PLATO, in which he put it *metá* (offside) *phýsis* (of nature), this thinking apart from physics is also very popular today: Not few physicists have also settled with this second world of mind and spirits as a supposed fact. Now philosophers are free to believe in a metaphysics and to theorize about it. But physical thinking should not be afraid to measure these ideas against reality.

Now the physicist also thinks himself. One can take this physical thinking and cognition as a starting point and try to define it within the framework of physics itself: Physical cognition means first of all to form models of reality. In an iterative process, the models are improved again and again by comparison in order to represent reality more accurately and better. Thus, physical thinking ultimately involves a mapping, quite in the mathematical sense.

Every physicist knows now that one can also form mathematically and physically correct models without there being a corresponding reality to it. An example for this is the technology, where one can consider physical constellations, which are not known up to now. Rolling resistance has been a perceptible physical phenomenon only since the invention of the wheel. It is assumed that the effect also existed thousands of years ago, when nobody had physically defined and measured it. And one can even be sure that this effect existed in reality also before the existence of the first wheel in the form of the structure of all physical interactions involved. A physicist could have predicted the rolling resistance if he had thought of a wheel as a physical model before it existed in reality. But only when a wheel had been realized could the predicted rolling resistance have been proven. Only the mapping of a physical model into the existing reality shows the truth of the model. The model is compatible with reality, it works - or it is wrong, because it does not work in reality. However, the fact that something does not work does not mean that it is not real. If you can match a model with reality and find that there is no solution for it in reality, i.e. there is an empty set, you have therefore not left reality and also not left physical thinking. Laws of nature describe not only what is, but just as what is not and what cannot be!

And one can go even further by explicitly designing models that are not true in reality, or by not even bothering to compare the models with reality, i.e., by not checking the functioning of a thought model in reality and considering it relevant. Nevertheless, they remain part of reality. If a mapping leads to an empty set, this does not mean that mathematics or physics has been abandoned. Only no solution for such a thought model exists in reality, a quite normal process in physics and mathematics. One can call the occupation with such in reality empty sets 'metaphysics', but one has not entered thereby into a second world outside of the physical reality. And, of course, metaphysicians can take the liberty to think up any theories they like about the empty sets and non-solutions you are considering - thoughts are free. But the physicist can and must determine the truth of these ideas without any metaphysical category by pure observation at the reality.

So there is no reason why physical thinking, i.e. the mapping from models to reality and vice versa, does not potentially encompass everything that is in reality, including empty sets and undefined functions. Where should metaphysical be found besides this comprehensive reality, except as an empty set of reality?

III. THE REPRESENTATION, THE LANGUAGE AND THE MATHEMATICS

To grant thinking a physical reality in the sense of a representation may not be intuitively catchy for one or the other. But let's consider a purely physical representation, namely an object which casts a shadow in front of a light source. Everyone will understand that only physics is involved here. And of course, I can see the shadow as a model, a representation of the object in the light. I can infer from the shadow properties of the object, but also of the light source, and that the better, the more detailed I know the physical laws. And vice versa, with the help of the laws of nature, I can predict what a shadow would be like with a given light source and object. Perhaps this shadow in turn falls on the sensor surface of a camera, where the electronic signals created there have been mapped into the memory of a computer, where in turn the program chatGPT forms the word, for example 'sphere' or 'skyscraper', based on this pattern using its AI knowledge. This word, too, is then simply another mapping of the original object. Abstractly, structures are formed in this process by means of physical media (light/shadow, charges, printed letters, or the like). An information process, in which physical laws as well as logical rules, which feed back for example in the AI or the human brain, are connected.

In linguistics, a four-level concept for the functioning of models has emerged (Fig.1), according to which a set of signs (letters) can be connected by a set of logically defined linking rules (syntax, e.g. grammar), where only a part of the links exists in a real meaningful, i.e. defined way (semantics). With a final effect (pragmatics) a model can be defined in this way. Physical models can be understood quite similarly. All possible variables can be put into relations according to mathematical logic (syntax), whereby one recognizes no equivalent in reality for some relations (semantics). Physical models that correctly represent reality can be seen as laws of nature (pragmatics). Such physical models are matched with reality, where the variables represent the existing phenomena, the potential structure of the phenomena is formulated by mathematical possibilities, and the realized structures are formulated as physical reality. The development of the structures is then parallel to the natural laws of the physical model.

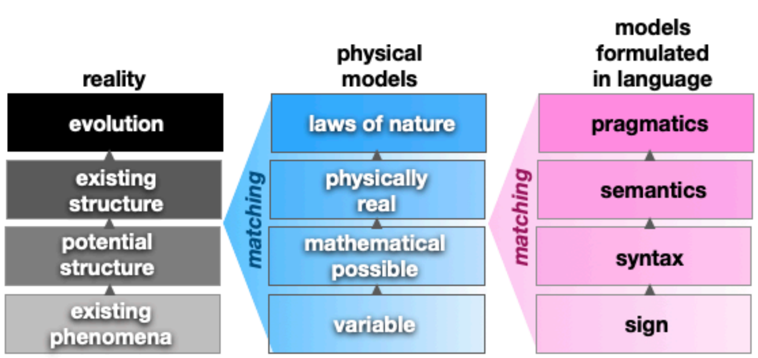

Fig.1: Models

Compared to models that are represented in common languages, mathematically formulated concepts and concepts that have been physically tested in reality can explain complex structures that occur in reality more precisely. For technical systems in particular, incredibly detailed and complex physical models are now available which, for example, realistically model many aspects of a car, including the acoustics of the slamming door. It should not be irritating that up to now much larger sections of reality cannot be explained by physical models, although physical modeling can become more and more efficient by means of programming languages. The physical understanding of the reality is thereby greatly expanded. Of course, besides the ever more precise and complex mapping of reality into physical models, the traditional, highly simplifying representation of reality into a technical or colloquial language has its uses, such as compressing all the information of a complex physical model of an automobile into the three words "old blue car." But the old hope that physically inaccessible, metaphysical information may be hidden in such formulations is outdated.

In the end, mathematics and physics are 'only' the syntax and the semantics of a language, with which one can formulate very close to reality, as in physical thinking. That the physicists can represent cars, iPhones and nuclear power plants in this thinking, impresses the actors themselves probably most, whereas other contemporaries consider questions as for example after morals, after the sense of death and the future of the climate as more important. This is not a problem of physics, but only, as mentioned above, of physicists. The alone occupation with energy and matter in the different scales of reality is too limited.

The extension of the physical thinking, which is obvious with the deconstruction of every metaphysics, can begin and it offers itself for this purpose to examine the systematics in Fig.1 once more: The pragmatics of reality is there called "evolution", the semantics and syntax emerge as "structure", which means more generally information. Here could be the important fields of future physical thinking and new knowledge acquisition.

IV. EVOLUTION AND INFORMATION

Evolution is generally regarded as a biological concept. In fact, Darwin had gained his insights of evolutionary processes on plants and animals, and until today evolutionary theories have been intensively developed in biology. In the meantime, the evolutionary model has also arrived in social categories, for example when people complain about social Darwinism. However, much more interesting evolutionary phenomena can be observed in technology, for example in innovation cycles and product developments, which can be observed there under comparatively defined and transparent conditions. Terms such as "mega-evolution", which aim to describe a world evolution from elementary physical worlds to the socio-technological present, suggest that a theory of evolution could also develop explanatory potential in physical systems. For natural laws in themselves always describe a development from a starting state to a final state, which in turn is the starting state of a new developmental step and thus always causes changes. What is reflected in the almost too trivial principle of cause and effect, grows in more complex structures to evolutionary processes, which must be explained by natural laws according to mathematical logic. The fact that biology has so far not seen the forest for the trees and that there is no generalized physics of evolution does not mean that there cannot be such a physics. Although the emergence of physical phenomena is increasingly accepted as a concept for the emergence of new physical effects in new scales, a generalization of the process itself, detached from the respective specific physical conditions of an emergence process, is still largely lacking.

The mathematical logic of evolution should lead to a law of nature that can explain how the world evolves as a whole and in every detail and thus should be a scale-invariant, very elementary physical principle. The skepticism of admitting such questions as physical problems is not to be resented by traditional physicists. They ask what physical unit associated with evolution might be associated with the SI system. A correct question, because physical units point the inevitably physical way to measurement, to comparison with reality. But one can also put this criterion at the end of the process of knowledge and determine that a physically defined evolution is only acceptable if also the question of its measurability and thus the physical comparability with reality has been clarified.

A hint is given by the second open variable, which is called "structure" in Fig.1. Structure can be understood as information, because a homogeneous, unchanged situation does not carry any information, only when structures and patterns become recognizable, information is present. For information, the bit has established itself as a technical unit of measurement, even if the measurement is only trivially defined and is not further anchored as a unit. One speaks gladly of a pseudo unit, with which the information is marked as not physical size. In fact, the use of the term information in the physical literature is ambiguous. The definition according to Kolmogorov seems contradictory to the also not always uniform use in connection with entropy, whether information and the capacity of an information channel can be used synonymously remains open. And can one make it so simple and equate information with a system state? Information lacks conceptual sharpness and an anchoring in physics. It leads to the question whether and how information and the mediation of physical effect are intertwined. After all, the structure in its current form is also a result of previous physical effects and thus information about the history of the system. And thus a relation to evolution, i.e. to generalized laws of development, cannot be dismissed out of hand.

To what extent evolution and information can actually be the central nodes in a new physical model or whether in the end other concepts offer themselves for explanation remains open. In any case, they would be attractive entry points for approaching questions that metaphysics has not been able to solve so far and probably will not be able to solve for methodological reasons, but whose clarification could provide important contributions to a better understanding of reality.

V. BOTTOM LINE

Although technology has proclaimed the information age for a long time and although mathematics and physics are in the end nothing else than part of an information processing (Fig.1), today's physics shies away from systematically taking up the topic of information and solidly anchoring it within physical modeling. The first step to get further would be the abolition of metaphysics. This abolition is not directed against the metaphysicians themselves and the many people who believe in and need metaphysics, but exclusively against the physicists who use a metaphysics, a Platonic second world of mind beside physics as an evasion in order not to have to deal with supposedly non-physical topics.

In this respect, the deconstruction of metaphysics opens up a new realm of knowledge for physics. At the moment, physics is largely limited to the exploration of the real four-dimensional spacetime structure, which is measured and modeled from the smallest, the Planck cell, to the largest, the horizon of the universe, where the energy involved often seems to be a central aspect. When physics self-consciously occupies the area vacated by a deconstructed metaphysics, it will also be able to deal with dimensionless phenomena of reality. In the here necessarily short and simplifying treatise exemplarily the two facts evolution and information were pointed out, others may be perhaps more important. Certainly, the Landauer principle of determining minimal energies of state changes is not the only and perhaps even a less promising starting point to penetrate into this apparently dimensionless reality.

The fact that metaphysics has not found anything seriously usable in this area so far and physics has not seriously dealt with the area, should not be taken as an indication that no physical knowledge important for our understanding of reality could be found there. On the contrary: A common, congenial effort of physics would be worthwhile under circumstances.