Informational restrictions in the formulation of physical laws by researchers

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The concept of information is becoming a pillar of modern science [1]. Information theory is a necessary tool for describing physical objects and their evolution. To paraphrase Galileo Galilei, we can say that anyone who undertakes to study natural sciences without the help of information is trying to do the impossible. It would seem that modern science can predict research results with unlimited accuracy up to the value dictated by the Heisenberg inequality. However, we argue that the revealed laws of nature do not reflect the mechanisms of nature with absolute accuracy and that such an assumption prevents a better understanding of nature. This is not because of the mathematical methods used, but because of the researcher's limited conceptual understanding of the observed phenomenon. There is a great potential for modeling physical processes using the concepts and mathematical apparatus of information theory, taking into account the qualitative and quantitative sets of variables in the model. However, over the centuries, it has proved difficult to choose and define a system of units for the study of natural and technological processes and phenomena. Since each variable selected from the system of units contains a finite amount of information about the object of interest [2], scientists and engineers may consider using the concept of "amount of information" contained in the model to achieve a minimum threshold discrepancy between the model and the phenomenon or process under study.

The main premise of our research is that nature does not know theoretical concepts such as space, time, energy, entropy, and information. Although this statement looks far-fetched, in the author's opinion, an important statement follows from it: all the variables used to describe the observed physical phenomena were created by talented people (scientists, philosophers, engineers) in different historical epochs. Now, these variables are included in the unique system of units—SI (the International System of Units), which was further developed and standardized in 2020. The adopted resolution on the revision of the SI, redefining all basic SI units in terms of physical constants, became possible thanks to the unique stands and methods for measuring physical constants, as well as the improvement over time of methods for statistical processing of measurement results used by various research centers. SI is the most widely used unit system in science and

technology, although other systems exist, e.g., the Planck system of units, the British–American system of units, or the centimeter–gram–second (CGS) system.

Combining the information-oriented and theoretically-proven method with the construction of the realized SI, it is possible to formulate the accuracy limit of any physical law or formula describing an observed phenomenon. This has never been done before.

The purpose of this research is to provide a theoretically substantiated application of the phenomenon of random choice of a variable observed when a model of a physical process is elaborated. The suggested approach is based on the utilization of the basic element—the finite information quantity (FIQ) [2]—and the implementation of the information method described in [3,4]. Examples will be considered.

References

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