

# K.V. LAURIKAINEN EXTENDING THE LIMITS OF SCIENCE

Tarja Kallio-Tamminen

email: [kallio.tamminen@elisanet.fi](mailto:kallio.tamminen@elisanet.fi)

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## Abstract

The article aims to explore why Prof. K.V. Laurikainen because of quantum physics was led to the notion that consciousness and psychological phenomena cannot be excluded from the physical picture of the world, and what were the consequences of this assessment. It further investigates what kind of worldview Laurikainen himself defended and what he saw to be the major setbacks and ethical hazards if common understanding does not change accordingly.

## 1 My acquaintance with prof. Laurikainen

I first encountered Professor K.V. Laurikainen when starting my studies in physics at the University of Helsinki in the middle of seventies. He was lecturing one of the introductory courses and he immediately made a positive impact on a young student: This elderly professor seemed to have a serious and respectful attitude towards his task – contrary to the many young geniuses who treated the bulky classes of beginners like an unavoidable curse stealing their precious time from research.

After some years I also attended Laurikainen's course on 'Scientific revolutions'. This was a more philosophical class with captivating contents – Laurikainen was describing the actual process of how the philosophical ideas present in science had guided research, technical innovations and the development of societies. This was so much more interesting and real than the abstract theoretical courses, with invented examples, that typically were available at the philosophy department.

When finishing my master's thesis on the EPR-paradox I moved into countryside. Instead of competing for a career in elementary particle physics I enjoyed peaceful life and organic farming. I was also teaching physics in the nearby high school and when considering which of the many available textbooks to choose, it was possibly not surprising that I ended up with Laurikainen's books. The other books would not have given me much chance to take up philosophically interesting questions, – even if the pupils may not have minded too much. I still remember my surprise when, in the end of a multi-level voluntary course in physics, I finally got the chance to discuss the intriguing quantum phenomena. My usually so eager and competent students looked disbelieving and unsatisfied – somehow disappointed. The best explanation I could come to was that they had originally chosen the exact physics to feel safe. They wanted the world to be predictable. The strict deterministic laws in the universe should bestow humans the opportunity to use their knowledge for the benefit of all.

For me it was not so. I did not share the ideal of total control. I felt that we humans are part of reality, included in and dependent on a bigger whole whose depths are not yet known to us. Thus it was a relief for me that something strange was encountered in physics, something that did not support the idea of simple clockwork. The particle-mechanistic explanations certainly were good enough to advance technological progress but there was so much more in life. Habitual explanations completely missed our inner life and subjective experience. They did not give any basis for ethics or personal development. In short the mechanical view was demolishing to our culture by depriving all dignity and mystery of human life – an appealing view that was most touchingly maintained by the Romantic poets in the late eighteenth century.

These kinds of ideas got much response in Society for Natural Philosophy seminars that I found Laurikainen was organizing when I in the late eighties returned to Helsinki to

continue my studies on the foundations of quantum physics. I noticed that philosophy was not cherished in physical science circles. Strong belittling and opposition was centered against Laurikainen's ideas related to the Copenhagen interpretation and Wolfgang Pauli's ideas which he had been promoting since his retirement. The ugliest rumors told that his logic had failed and he was advocating religious irrationalism.

I do not believe everything I hear, but nevertheless I decided to avoid a direct contact with strong and determined Laurikainen to create my own independent view. I moved into the philosophy department where I studied the foundations of quantum mechanics from books, doing my best to understand and evaluate the different interpretations, their metaphysical basis, and implications. After some years I ended up with the Copenhagen interpretation, but with Bohr's ideas rather than Pauli's. Still, my approach was close enough to Laurikainen's to make him contact me when I finally published something. We met and discussed. I was pleased to be acquainted with this deeply humane person who had chosen to carry "the message of atoms" on his shoulders wherever it may take him and whatever it would demand. He managed to recruit me as a secretary for the planned third Symposium on the Foundations of Quantum Physics in Helsinki, and related to the succeeding many meetings Laurikainen used to tell me extracts about his life, his outstanding teachers like the mathematician Rolf Nevanlinna and the philosopher Eino Kaila, as well as his studies and positions abroad and meetings with international celebrities like Pauli and Bohr. Most of all he however relieved his mind regarding the stressful situation he was encountering at the physics department. How the decisive authorities – mostly his former students – opposed his views and did not let him any more keep even the modest little room in the uppermost corner of the house, the 4 storey Laurikainen building, he had once accomplished for them to use.

I felt sympathy for this once so influential man in physics in Finland. He had started by promoting the level of physics at the University of Turku, deteriorated by the war and then he thoroughly modernized research and education at Helsinki where he established a solid basis for theoretical physics, nuclear physics and elementary particle physics as well as for a computing centre by using his strong willpower [1]. Laurikainen was used to calling for funds and achieving whatever he considered appropriate but now the opposition seemed to exceed his present means. His former colleagues, not surprisingly, were not willing to accept, that consciousness or any psychological aspects should be included in the physical picture of the world. They did not support Laurikainen's attempts to strengthen the research and teaching of natural philosophy in the university. [2]

The opposition certainly did not encourage Laurikainen. To promote his ideas he frequently appealed to various quarters: the head of the University, the directors of the Academy of Finland, etc. He turned towards the key figures in philosophy, theology and the media. He was tireless in organizing debates and seminars – he certainly struggled, in all possible ways to combat the opposition which he believed was caused by misunderstandings and too narrow a conception of science. Finally at the age of 81 he even wrote another doctoral dissertation *Science has its Limits, Ontological Implications of Quantum Theory* to force official debate concerning the philosophical implications of quantum mechanics and the role of natural philosophy. Ultimately he probably dreamed about a self-governing institute for this important discipline which "should be sufficiently independent of both natural sciences and of philosophy although closely collaborating with them". [3]

In the midst of this fierce struggle Laurikainen undoubtedly sometimes was heated and disappointed and he used strong words in his writings, but I never heard him directly accuse anyone. He probably knew that in his former years he might also have preserved the limited funds for more concrete and urgent needs. He also knew that his intentions were difficult to understand and sometimes he even asked me how he could formulate the things in a less ambiguous manner. I had to admit that he was not at all

as stubborn with his ideas as I had once assumed. He would certainly have loved to find someone willing to discuss thoroughly the deep issues that haunted him.

It was not easy for Laurikainen to get the second dissertation acknowledged and publicly defended. The University of Helsinki refused to examine the manuscript but in Oulu it was finally accepted. Everything was arranged and the date for public defense fixed with the official opponents Charles P. Enz and Kari Enqvist when Laurikainen passed away on the 13<sup>th</sup> of July 1997. Just a memorial symposium with a panel discussion took place on the 22<sup>th</sup> of August in Oulu. I was honored to represent the Society for Natural Philosophy on the occasion.

When I for the last time met Laurikainen in the beginning of the summer 1997 he expressed his gratitude that the international examiners Charles P. Enz and Hans Primas had understood the value of his work and had given positive statements. It was also a pleasure for him that the main part of the treatise was soon coming out from Springer under the name *The message of atoms: Essays on Wolfgang Pauli and the Unspeakeable*. I had no idea that Laurikainen was having any problems with his health but he also made the somewhat astounding comment that he was satisfied that he had at least “managed to clarify the points of difficulty to make it easier for others to continue”. I do not know whether it was meant to be any legacy for me but at some level it certainly affected me like that. I have never forgotten Kalervo Laurikainen’s honest trial to take the message of quantum physics seriously. He did his best to pay public attention to the fact that psychological factors do contribute to the development of things even in physics. But to drive this kind of insight by crusading against prevailing institutions was certainly an example to be avoided – if one does not like to end up as a martyr.

Yet, I knew I was not prone to meet this kind of fate because of my different temperament, and my adherence to Bohr instead of Pauli. Both these Copenhageans were rebels but Bohr’s flavor is certainly less apt to arouse suspicions. It is also more persisting and substantial. If, armed with that I would end up in a trap, its type would be different.

## 1.1 Various flavors of Copenhagen

The Copenhagen interpretation of quantum mechanics was developed along with the construction of the theory. The Niels Bohr (1885-1962) Institute in Copenhagen, founded in 1921, was famous for its open, interactive atmosphere that attracted many researchers. By 1930, some 60 physicists from 17 countries had visited the Institute for longer or shorter periods. Especially Bohr managed to collect together young talents like Werner Heisenberg (1901-1976) and Wolfgang Pauli (1900-1958) who were ready to look for new kinds of solutions. The Copenhagen interpretation came to reject the prevailing ontological and epistemological approaches by discarding the principles of determinism and the idea of humans as detached observers, which had for centuries been the cornerstones in natural science. Everyone involved knew they were re-evaluating the whole tradition of natural science, and handling matters of great depth and philosophical significance, but nevertheless the interpretation was never worked up into a systematic presentation. In details their viewpoints and emphases differed quite a lot. According to Heisenberg, he himself was essentially the mathematician, Pauli was the critic and Bohr was above all else the philosopher emphasizing complementarity and the epistemological lesson provided by quantum mechanics. [4]

I liked the epistemological approach emphasized by Bohr. As a philosopher Bohr was to a great extent *'sui generis'* a physicist forced by quantum theory to reconsider the role of humans, knowledge and objectivity. He probably shared Pauli’s belief that renewal of the conception of reality was the most important task of the age – a view that was often repeated by Laurikainen, but unlike Pauli Bohr was not willing to postulate any new ontology. By reconsidering the role of humans and the character of their the-

ories and representations one already achieves a deep change in the attitude towards nature. Ontological pictures are less important. At best they are partial descriptions completing each other – valuable tools, which should not be taken to be final truths. Immaturely done a new ontological model might even lead the further research astray.

This was something that Laurikainen did not see or at least was not willing to accept. He was fascinated by Pauli's profound ideas and metaphysical intuitions, such as *Anima Mundi*, cosmic archetypes or quaternary which aimed to catch the transcendent reality behind phenomena. Laurikainen in many cases criticized Bohr who did not reflect on such matters. He believed that Bohr made too many compromises to traditional realism and materialistic philosophy and thus somehow betrayed the most important issues. I rather think that Bohr was more able to stand uncertainty. In the midst of many fascinating possibilities a scientist is supposed to keep all the options open. Bohr did not rush to fill in the gaps by postulating dubious entities. Even if conception of reality necessarily contains metaphysical ingredients, it is just reasonable to wait for appropriate evidence before one makes any far reaching conclusions.

I have discussed elsewhere [6] the points I disagree on with Laurikainen. Most notably I dislike his view on irrationalism, and the claim that quantum mechanics only describes *our knowledge* meaning that the matter waves – i.e. the state function of quantum mechanics – do not refer to 'reality-itself' but are only a symbolic shape in the consciousness. I do not so much dislike the ideas themselves, what Laurikainen to my mind was searching to express, but the misleading connotations and distinctions which are inherent in his wordings. Yet, I do not go into these details here as the differences between our views are not as important as the similarities we share.

The Copenhagen approach promoted quite similar conclusions in us related to the limits and distortions in the present worldview, and consequently in the scientific approach. They will be briefly discussed in the next two chapters.

## 2 What proved to be wrong in the approach of classical physics

Laurikainen emphasized that we cannot solve our present crisis if we do not acknowledge that the roots of science are in metaphysics. Physics and metaphysics must learn to live side by side – so also scientific knowledge and belief [7]. In quite a similar manner I have been repeating that quantum phenomena, such as wave-particle dualism, entanglement or statistical predictions cannot be understood within the particle-mechanistic context. The theory challenged the deepest metaphysical assumptions related to reality which were adopted along with classical physics in the beginning of the modern era, thus initiating a deep paradigm change.

Conception of reality – worldview – is the ultimate context within which people in a given time and culture tend to conceptualize everything they encounter. It is a cultural construction, mega paradigm, which does not change often. An individual who grows up and gradually learns to conceive things in a certain manner may take the habitual pattern as so self-evident that its very existence goes almost unnoticed. Since the beginning of the modern era we have been taught that reality consists of matter in motion. It is comparable to clockwork: mechanical, quantitative and without any purpose. The view was based on solid mathematical theory, Newtonian mechanics, and confirmed by accurate empirical observations. It was taken to be true, and also the unwarranted metaphysical presuppositions such as atomism, determinism, reductionism and detached external observer became generally accepted.

The particle-mechanistic framework was good enough to give a reasonable understanding of many phenomena. It was appropriate to solve countless problems and boost huge technological progress. Yet it contained quite serious anomalies and limitations. In particular the framework does not provide any basis or space for the existence

of consciousness, freedom or responsibility. It is not able to explain how humans are related to nature. The flaw resulted in a split between two cultures. The breakdown of proper communication between the sciences and the humanities has been the major hindrance to solving the world's problems as C. P. Snow stated already in 1959. If this kind of fatal split is not bridged it will be impossible to find a basis for good life and sustainable future.

It is by no means easy to display coherent answers to the ultimate questions. Empirical science may, by producing new results, sometimes disprove previous beliefs but it does not have any direct access to metaphysical issues. The new phenomena revealed along with quantum mechanics generated a prolonged interpretation discussion related to fundamental questions. In addition to the Copenhagen interpretation there are adherents to e.g. many-worlds interpretation, Bohm's interpretation, statistical interpretations, decoherence and consistent histories. Each of these interpretations relies on a different set of metaphysical assumptions, and thereby implies differing kinds of changes to the worldview.

The discussion has now been going on for almost a century and it is still premature to assume the metaphysical quest to be settled soon. Yet, it is a good start that quantum mechanics revealed the presuppositions adopted with classical physics to be half-truths which are not applicable outside the macroscopic world. Reality is not deterministic and everything cannot be explained with material bodies moving in space-time. Nobody really knows (1) what is the basic stuff everything ultimately consists of, (2) how do the objects and their properties emerge, (3) how the parts and the whole are related together, and especially (4) what is the role and locus of humans. The bigger the change the longer it probably takes to shape an alternative approach – even if, in addition to quantum phenomena, a new synthesis is needed in order to get a coherent understanding of many results which are emerging from fields such as complex systems, neuroscience, epigenetics, or bioinformatics.

Thomas Kuhn in his book *The Structure of Scientific revolutions* [8] convincingly showed that a great paradigm change always changes the old rules, and raises new questions, categories, and distinctions. Now when we are living amidst a great paradigm change there is a real opportunity to create a framework where the old controversies between science and humanities, or Western and Eastern thought may disappear. All that is missing is a competent and courageous enough philosopher to make the shift. Someone of the worth of Plato and Descartes, able to conceive for us a new truth and reality.

## 2.1 Revelations of quantum physics

Quantum mechanics revealed a lot of interesting facts and phenomena which are valuable when aiming to understand reality better. Compared to Newtonian physics quantum theory is based on revised state description, which implies a new kind of wholeness, inherent interconnectedness between things. In addition to external relations there are subtle non-local connections between seemingly separated parts. According to different interpretations the new kind of invisible factor, suggestive of Pauli's archetypes, affecting the formation of matter may be called a field, potentiality, or information. Reality can be seen as a complex, partly material entity which is evolving within certain statistical limits, and can be inherently affected also by human beings. It is certainly more reminiscent of the One, many layered existence typically described in perennial philosophy than the clockwork of classical physics.

According to Laurikainen the properties of independent reality began to acquire features characteristic of a living organism. When talking about this he often drew attention to Pauli who became interested in Jung's depth psychology and postulated archetypes to be the basic elements of the psychophysical reality, *unus mundus*, in the same

sense as ideas are the basic elements in Plato's ontology. When, however, the archetypes are supposed to create new shapes (Gestalt) and themselves undergo changes, they have an essentially dynamic nature. Thus unus mundus is an evolutionary world which expresses itself for us as mutually complementary physical phenomena and mental experiences. The controversy between the biological theory of evolution and the idea of creation disappears: evolution can be understood as continuous creation. [9]

I myself find the old ontological and epistemological ideas related to Indian philosophy much more satisfactory than Pauli's quite narrow and tentative view – and probably this was the case with Bohr himself who designed the Taoist yin-yang symbol to his coat of arms when he was knighted in 1949. Nevertheless the basis for our search for a new frame is the same. Quantum physics provides tools to overcome Cartesian dualism. The psychophysical problem can be seen in a wider context. The close relation of observer and object comes to the forefront in the measurement problem. The observer is not just detached when by choosing to measure something s/he affects what kind of observables will be realized, in a statistically predictable manner. Measurements do make a change to the irreversible unfoldment of events. Human choices and history shall not be excluded from the objective reality.

### 3 Exceeding false beliefs

Laurikainen was extremely concerned about the limited materialistic view still prevalent in our culture. He often repeated Pauli's saying that the basic direction of Western culture needed correction because "they went a little bit too far in the 17<sup>th</sup> century" [10]. In his youth Laurikainen used to admire science and he put his hope on it, but after the Second World War he started to hesitate. Scientific method should not be overestimated or misused. Scientific dogmatism may be dangerous to our culture. When a scientist demands that religion should be replaced by science he does not differ from other fundamentalists [11]. Laurikainen was concerned as he clearly understood the essential, even if often implicit, influence that the all-embracing cultural atmosphere and conception of reality has on people's life, and on the direction of research. Laurikainen himself had learned to fix the defects he noticed in his surroundings by appropriate administrative revisions. He probably believed that the conception of reality and the direction of human activity could be changed by establishing a high level institute concentrating on the study of natural philosophy. Proper knowledge would straighten the distortion and have a revolutionary influence on Western thought. One important implication would be a more positive relation between science and religion which Laurikainen took to be two complementary ways of approaching one and the same reality.

I also think that when humans are immersed into reality, an aspect or dimension which can be called spiritual becomes a natural part of it. Nevertheless, because of Bohr I think I see the situation in a somewhat wider context than Laurikainen and Pauli. They seem to accept quite traditional concepts of science and religion. By being complementary both are limited in the sense that they are not able to enter each other's area. Thus when religion is reclaimed, science is doomed to be limited. And this is what Laurikainen was saying when he stressed that science has its limits. He never entered the task of really extending the limits of science, meaning its method. To my mind there is still too much dualism in this kind of science-religion complementarity which takes the things as they are traditionally conceptualized and thus sticks on the ontological level. Bohr's radical shift from ontology to epistemology is missing.

Along with Bohr it is possible to broaden the context, and transcend the dualism of different limited views and approaches. Science and religion need not stay contradictory but are allowed to complete and enrich each other. As humans we need various kinds

of approaches, models, constructions and distinctions to understand things better, but we should not take any conceptual model too seriously. Not even the best of them should be taken as a final truth that fundamentally corresponds to reality. Our mental creations are just tools that we need to understand various things, to widen our horizons, but eventually we should rise above them. Skipping over to a more sophisticated conception at the right time is imperative for personal growth and cultural advance. This kind of development may transcend language and all the limited models provided by logical reason, but it does not contradict physical laws or empirical results.

The concept of consciousness entered the vocabulary of physics along with quantum mechanics. It refers to something that has evaded the grip of science in spite of growing interest during the last decades.[12] How to describe and explain the very thing on which the whole activity of knowing is based? The objective third person approach is bound to miss subjective contents and it does not really help when proceeding to understand things like mental states, selves, agency, or volition. To my mind science should not be limited to its traditional sphere but by proper widening of its method it would be possible to enter the domain of introspection and inner experience – after all we do already have devices that can be used to translate mental contents into the language of brain functioning. We can see how our intentions and deliberately maintained mental states do have an influence on the functioning and architecture of the brain. It is time to admit that psychological factors cannot be excluded from the physical picture of the world, which was the main message Laurikainen undertook to deliver.

## 4 Conclusion

Quantum physics taught us to transcend the duality of mind and matter. We are not only observers but actors as well, evolving entities that are immersed in reality with all our mental, emotional and material aspects. When the core of reality is not supposed to be mechanical and material mental states do not need to be identified with brain states. There is plenty of room for the subtle activity of thoughts, emotions, and for their conscious conduct and regulation. Humans are allowed to be more than just automatons – a view which reclaims our dignity and makes us more responsible for the opinions and views that guide our actions.

Reality is certainly much richer and deeper than are the theories we create to understand it. In addition to reason and logic we have distinctive inner capabilities to sense whether our ideas, values and acts are in tune, in a proper balance, in given situations and surroundings. There is something in human beings which makes us able to evaluate whether we should adjust our behavior, or create better hypotheses to understand what is really going on. This inner core of humans is very much unknown to science. It is probably what Laurikainen was talking about when he with great reverence referred to the Irrational. I would not name it so, but nevertheless I too put my hope on this deep unknown territory which is the source of our conscious mental activity, conceptions and models. It has to be seen as the source of our will, morality and responsibility too – until future science hopefully manages to chart our inner capabilities and dimensions in a more detailed manner.

I just wish there is enough wisdom and strength in us to set us free from the outdated beliefs that suited the building of the modern era. It is now time to move on into a less restricting framework where the old controversies between science and humanities, and Western and Eastern thought may disappear. K.V. Laurikainen certainly was on his way towards this noble end.

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