The Einstein-Podolsky-Rosen-Paradoxon (EPR) revisited

Transcript of a lecture by

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given at the Niels Bohr Institute on June 28, 2007

AVANT PROPOS

The Problem and the Solution.

The problem raised by Einstein-Podolsky-Rosen is : who would accept a description of observations by spook?

The solution is that the spook only exists in the beholder's eye.

Teleportation does not exist, only for who forgot of a conservation law.

The real problem of Einstein-Podolsky-Rosen after John Bell is : will the two pillars of Einstein's physics be unified?

The solution is that Einstein based both on entropy vice action which a r e unified since Boltzmann 1866 and Gauss 1829.

Isn't this one big step closer to fulfilling a grand dream, to formulate a unified theory comprising gravity as well – a theory for everything ?
http://nobelprize.org/nobel_prizes/physics/laureates/2004/press.html

Gauss created unified geometry and probability worlds by One „im Denken des Mathematikers" - in the thinking of the mathematician.

I have rooted this unification in the visual of brain's integrative action.

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The Solution of the Einstein-Podolsky-Rosen-Paradoxon

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Abstract.

The Einstein-Podolsky-Rosen-Paradoxon (EPR) has since its publication 1935 called all pioneers of quantum mechanics for comments, attempts of solution, and serious concern throughout their lifes. No solution had ever been found. In contrast, not to consider it at

all, or at least not to consider it a paradoxon, has become the way to deal with the failure of even Einstein, Bohr, Heisenberg, Schrödinger, Pauli, Dirac, Landau, Feynman, Wheeler, Bohm, Bell, Penrose or Hawking in theory and of say Clauser Aspect Gisin Zeilinger and others in experiment.

Nobody could prevent the spooky action from remote, nor the little noticed falsification of the Heisenberg uncertainty relation by EPR, when confirming else the Copenhagen interpretation of quantum mechanics whose Heisenberg „indeterminacy-relation“ Einstein considered finally demonstrated, too.

Here I show that the key to the solution had been lost in oblivion long before the rise of quantum mechanics and relativity.

Introduction

I discovered that, as not infrequent in the history of Science, early and forgotten notice by the founders of a unifying philosophical, mathematical, and then revolutionary physical approach, here by Einstein, Bohr, and Heisenberg, creating the present schism in relativity and quantum theory, and EPR, does solve the paradox that had been unsolvable to anyone before.

The result in this case of the solution of the EPR paradoxon is the original principle unifying mathematical physics before the introduction of freely chosen view-points of the observer. Earlier called entelécheia, moindre action, kleinster Zwang, and later least action in the already paradox form of Lagrangian, Hamiltonian ; and the distinct of the rôle of time in quantum mechanics or time-space in general relativity ; and most generally the distinct rôle of observation, in the brain as in philosophy.

This is obeyed by this now unifying origin in the „least“ of something far more general, leading to Gauss’ „least squares“ when geometrising error law, and to the superior „Boltzmann correspondence principle“ between the original least action and the entropy potential.

I prove this solution unique by its inescapable anthropology. In particular, Bell’s request on the solution of EPR is fulfilled, and Einstein’s two pillars of physics’ world view are unified, that separated general relativity and quantum theory to this date. Einstein, in conclusion, was right on EPR, but could not find the solution. Bohr’s correspondence principle is the „reduced“, and paradox-creating, form of Boltzmann’s. Feynman’s paths like Dirac’s contact transformation came closest to but missed the solution of EPR, since even the Lagrangian form of the principle has no way back to the original unity.

The experimental conclusion applies to results from Paris, Geneva, Innsbruck, Vienna, Munich, Copenhagen and laboratories all over the globe. As a result, there is no teleportation and „God does not play dice“. The human observer’s view-point, however, is free to chose between geometries and errors, variational analytical geometries and probability, and various forms of „least action“ and „entropy“ as foundations.

Now, clocks turn posterior in quantum theory, too, as in relativity. Dirac spins or rotating Gödel universes can no longer separate the world views on large-scale and small-scale. Space-time remain „correct“ descriptions of physical reality. They however are

„incomplete“ due to the free choices made by the human observer which created „paradox“ correct descriptions. These paradoxes are solved by the Gauss correspondence between least squares in geometry and least squares in error law, that is, Boltzmann correspondence between the then physical „least“ paths in the freely chosen view-points in action vice entropy. To the observer then, „God does or does not play dice, pending on the view-point chosen.“ This unifying entelécheia, or moindre action, or homoeo-ousia, of Einstein's and Spinoza's God has created physics' world view. It does not play dice.

It is only now clear why the quantum is a quantum of action and not of energy. It is also clear now only why the cosmic background is void of space-time, governed solely by entropy and the quantum of its corresponding action. This correspondence remained unnoticed despite implicit in Planck's discovery of the quantum 1900/10/19. The result has implications on Doppler views on red-shifts, Big Bang origins, Planck's law, and cosmic origins, as it has on uncertainty relations for wave-particles of light now void of EPR.

The oblivion of Boltzmann's, Gauss', Leibniz' or Descartes' and Aristoteles' unification in the foundation of present mathematical physics has made the EPR paradox possible, and its rediscovery its solution.

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The Niels-Bohr-Institute Lecture on

The Einstein-Podolsky-Rosen-Paradoxon (EPR) revisited

http://www.nbi.ku.dk/side94078.htm?foredragid=5714&lang=da

Thomas Heimburg (TH, chairman) :

It is a pleasure for me to introduce Konrad Kaufmann again.

He has done all kind of things in his life including nerves and biological systems, but now he is interested in the principle of least action and entropy laws, and in most recent years he has been trying to put these things together in a way that he believes solves the Einstein-Podolsky-Rosen-Paradox.

He has given a number of talks before on that, where he has introduced us into some of the concepts, for example some basic papers by Gauss and Boltzmann in the last year.

As far as I understand he has thought himself much deeper into some of the basics of Carl Friedrich Gauss, whom we know from Göttingen where we both come from originally, and I am very much looking forward to what has happened to prove it on this very famous paradox.

Konrad Kaufmann (KK):

I thank you very much that I am able to talk to you, and I think I will use not much time to go very much in detail of the Einstein-Podolsky-Rosen-paper but will just for anybody who has not seen it give you just these four pages of the Einstein-Podolsky-Rosen-paradoxon, with no relation at the moment. We start after only with the talk.

The paper of Einstein Podolsky and Rosen is what in classical philosophy is called falsification by „reductio ad absurdum“, meaning, and it is considered by the classical philosphers such as Aristoteles, the prior falsification of a theory :

We assume everything a theory assumes. You assume it with all the premisses. We assume it is all correct, und we never go away from this assumption. And then you draw consequences of the theory, which no one can avoid. And you by exact conclusion arrive at the contrary.

So, using the theory, you prove the contrary of a crucial assumption.

And I only show you esthetically, how in these four pages this is done And later we will go then in detail through the whole thing.

The „reality“ discussion I will not put in here, this one can put at the end, because it is not the crucial point for a „reductio ad absurdum“. It is only the crucial point for what does that reductio ad absurdum mean for the physical reality and any other reality.

So the whole thing goes that way, and can you just slowly let go the power-pointed original article from 1935. The whole thing starts from saying : we don't question whether the theory is correct , the quantum mechanics, we just go and assume it is correct and do all these nice equations which we know for a wave function, the eigenfunctions, and we do that for the special case that we do at the moment, and then we insert the crucial assumption.

This is the Heisenberg uncertainty relation, in this differential form.

And now we go on and we show that then, when one variable is certain, that

canonically conjugated one cannot be certain. And so we go through the EPR paper.

This is the part 1. We just define the system.

And now comes the part 2, which is crucial, and which actually Dirac and others have done before : now we let collide two such functions. And now we go down the next page.

The key point being that :

if we have the quantum mechanical system of axioms, including the probability functions and their interpretation, then it must be so, and it is not disputed, that if two wave function, two particles collide, that you have this common wave function which is the product, because probabilities multiply.

And then, exact consequences of that are drawn, with complete Hilbert space arguments in the one or the other Hilbert space. There is no doubt about all these things.

And now we come to the next page, where the conclusions are drawn for these two particles which have collided and are now far away. And now they are far away from each other, so far that they cannot interact. And then we do the same game, but now for the product wave function.

And we look at the observable. And once we take of that particle 1 the momentum, and the other time, free to our choice, we measure of the same particle 1 the location. And we do this with complete Hilbert space things. There is nothing to discuss about.

And now we go a little later, and we come exactly to the contrary, in that following sense :

When we make the measurement on the particle 1, and we are so far away that we have no way to influence what should be going on there in 2, then the result of the observer there in 2, which is written down there in equs. xx, will depend on the free choice of that observer here in 1. So in the one case 1 takes a grid and measures momentum, in the other case 1 takes an absorbing plate and measures the location of this particle 1. And all-of-a-sudden, we see another result. And in 2 something comes out completely different. And you identify by exact methods that this completely different is due to somebody who has no way to interact, being too far away.

And this difference in observation is due to his free choice and without in any way having had any influence.

And the four pages conclude with a very sensitive case of this whole class of exact results, which I do not find cited in the literature very much.

We can decide there to make the measurements such, that all-of-a-sudden we see h e r e the location with precision, no uncertainty of the location, and if you then by choice decide to t h e r e measure not the position, but the momentum, all-of-a-sudden you see h e r e the momentum with precision, although t h e r e was no possibility to influence.

So in this sense of two successive measurements there is certainty of both, momentum and location, due to the free decision of another remote and thus spooky observer who has no way to interact with us.

That is the key of the paradox, and I stop here, and we go through the whole thing at the end of my talk now, after I have solved the Einstein-Podolsky-Rosen-Paradoxon.

And I start my talk now.

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It is very simple - EPR presented for the non-physicist

Quantum mechanics does not touch for the whole system - the conservation law of the total momentum - the conservation law for the center of mass So there is certainty of the conservation law.

This certainty, together with the Heisenberg uncertainty, creates paradoxes in the Copenhagen interpretation. Einstein has in particular addressed paradoxes concerning - initial conditions - collisions Schrödinger has in particular addressed in the cat-paradox - the paradox role of time in quantum mechanics.

When in EPR two particles collide and then continue to remote locations, - their total momentum is exactly the same total as before, - their center of mass is exactly at the predictable location.

If you measure now one particle's momentum no matter how remote, since you know the sum, you instantaneously know the other's momentum.

There is no teleportation, just conservation law.

If you measure now one particle's location no matter how remote, since you know the center of mass, you instantaneously know the other's.

There is no teleportation, just conservation law.

Since the total momentum and the center of mass location are given, from the start, with precision, and there is no uncertainty here in the initial condition concerning the whole system, too, in the measurement at remote locations later, from the one's precise observation follows the other's with precision
b o t h for location a n d momentum.

This conservation law is not touched by quantum mechanics. It is observed without any teleportation.

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Now it is crucial that you do n o t recall that conservation law. None of the teleportation papers and reviews today clearly recalls that. So you now make, or suggest, the error n o t to recall this crucial fact.

T h e n and only then you must conclude teleportation, i.e. the spooky action from remote of an observer who has though no influence on the other observation, but who due to this error now has to account for the conservation law, and now as „Alice and Bob" communicates his „information" by „teleportation".

That remote observation can even violate the Heisenberg uncertainty for the other observer's particle, by his free and non-interacting choice.

That same argument made for time and quantum mechanics leads to the paradox of Schrödinger's Cat being both dead and alive.

The problem of EPR is very simple then:

teleportation does not exist, only conservation law. But this is not spelled-out clearly in the papers, it is rather made believe that teleportation existed.

Penrose, Bell, and all the pioneers of quantum mechanics who knew did not openly spell this out c l e a r l y , and I do so only since I can propose the solution of the Einstein-Podolsky-Rosen paradox, in contrast to the founders.

In particular, my solution does not touch the „correctness" and the experimental success of quantum mechanics in all cases where the too narrow assumptions imposed on the uncertainty relation are observed in experiment and interpretation.

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Krissi's Question (Kristmundur Sigmundsson, KS)

I start with Krissi's question. I asked him yesterday, who has listened to me many times in Stockholm already :

„What would be the Question you would like to really understand in this

problem? and you would expect to be answered in this Lecture on the EPR paradoxon ?"

And then he answered :

„I f you really solved the Einstein-Podolsky-Rosen-paradoxon, that would mean, there would be a kind of new physics, something will be different to if I have not solved it. That would be the question I would be interested."

So I decided to start with the end, with my three points

Vision of the New Physics without Paradox Precisely the Place of Present

Physics. Exactly what of that I prove today

I start with my vision, my view : how physics will look like without paradox.

That will be very much associated I should say to what Aristoteles' vision was, Descartes' vision was, Leibniz' vision was who invented the principle of least action, and in-a-way Gauss' vision was, at least for the mathematics the f o r m of which succeeded until today's mathematical physics.

So with this I start.

And then, in the Second Part, I place exactly what thereafter the place is of Einstein, Bohr, Dirac, Feynman and of the experiments in Paris, Vienna, Copenhagen, Munich.

Out of that vision e x a c t l y , I give you then exactly those points I am going to prove n o w , in this lecture, so you can pin me down on these points : t h i s is what I prove now.

This I do in a short version so you know exactly what I want to have proven after the lecture. And then we go and start with the New Mathematics, which is not so different from the Old Mathematics.

We change the question from

- calculating

with methods we are aware of, there are premisses we are aware of, and where some other people, like Gauss, like Euler, like Lagrange and so on, have developed a mathematics which we use, as a kind of daily method.

Henrik Bohr (HB):

The word New, isn't it very colourful, depending on what people think. I mean you say it is a thing that people will be very excited about and at least angry about, and they think that, with New Mathematics, and when you think of a New Mathematics, I am not thinking of some new equations, I am thinking in terms of New Theorems.

Have you got that ?

KK :

Ja. Yes.

But I don't have it yet in the same complete form; I apply the new mathematics the same way as : when in the early day Leibniz proposed the principle of least action in a naive mathematical form, he started from t h e r e . And it was later, that on this basis mathematical physics developped till the present elegant form that however Schrödinger criticised as „Formelkram" when it comes to address the paradox of what is matter.

I give you t h a t exactly, in the sense as Mitchell Feigenbaum has pointed out several times : we need a New Mathematics in Biology.

And this is the c r e a t i o n of mathematics. I will talk about it in a minute, I will go through it.

In this sense it is New, that I say we have to c r e a t e mathematics.

HB :

That will be crucial.

KK :

But we do it the old way, and I can tell you that I don't have the wonderful kind the mathematicians have developed, yet, for the New as for the Old mathematics following Leibniz and Newton who did it in naive form.

This will be the main part.

In this picture of how mathematics is created I tell you exactly where Gauss stands, and that he did create, and what I learned from him, and also Feynman then, and at the end where Einstein, Bohr, Schrödinger, Dirac used that.
That will be a kind of key part of my Lecture, where I want to have you - instead of methodological calculating - - which was done seventy years on EPR and without solution - to get back and say : we create ; as Feynman did.

Feynman tried, and Dirac, I'll come to that.

It is not new in that sense, that others have not tried exactly the same thing. The New is that I will do it on the level of Gauss, which I say has been lost in oblivion long before the rise of quantum theory and relativity.

And then I will give you how my solution of the paradoxon looks like, and that the Boltzmann correspondence 1866 is the - generalisation of Bohr's correspondence of 1928, in principle that the introduction of time and energy if prior is c r e a t i n g the p a r a d o x of the relation to the Hamiltonian things at the end which I solve by Gauss' today again New creation of Math which I use for the solution.
And at this point, I go through this Einstein-Podolsky-Rosen reductio ad absurdum in detail once more.

And then we make this crucial experiment which I promised in the Abstract :

That we take the experiments of - Anton Zeilinger in Vienna, of – Alain Aspect in Paris, of - Eugene Polzik here in Copenhagen, - Theo Hänsch in Munich and many others' and look at these experiments to test my theory.
But we have to look at it from t h r e e view-points :

1. Bohr's meaning we have read everything of Niels Bohr's Collected Works and I got this view-point ; and then I take
2. Einstein's meaning we have read everything of Albert Einstein and then look at the s a m e experiment again

   and then we hopefully have read everything and understood of Carl Friedrich

3. Gauss'

   third view-point. And we realise how, in which sense, these three are r i g h t . Everyone can just claim so.

   G a u s s , is the only one, Gauss' view-point, that s o l v e s the paradoxon.

   That is entirely n e w . We have found this and made public in 2005.

I can not exclude, what happened several times when Einstein was alive, that people claimed something, Schrödinger for example did so 1918, that Einstein said Yes, and he writes for instance to Schrödinger, „I have of course thought about this possibility. But I did not find it worth mention."
This he cannot do, he is dead. But I hope of our discussion, to do that.

;-)

So now I start.

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Lagrange Hamilton Boltzmann Examples $0 = 1 + e^{i\Pi}$, $0 = 1 + \exp(i\pi)$, π in error formula EPR in QM

Why New (or Earlier) Mathematics is required Why nobody could solve the paradox Einstein, Bohr, Heisenberg, Schrödinger, Dirac, Feynman

My solution of the paradoxon

The Boltzmann correspondence and Bohr's reduction The Second Law and the First Law's reduction The Uncertainty and the reduction by time & measurement The EPR „reductio ad absurdum" Bohr Einstein Gauss observing the experiments from Paris Vienna Copenhagen Munich

Vision of the New Physics

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Discussion

The Power Point Show The Last Tape of Niels Bohr (with Thomas Kuhn)

Readings from the Library 10 Points at the Blackboard

Pythagoras with variation next to Gauss' Law of Least Error equations path variation next to entropy variation time element selected Lagrangian form Hamiltonian form Boltzmann's form 1866 Planck's form 1900 Einstein's handwritten correction on time-space my form for the brain origin of Gauss' unified mathematics

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So now I start.

Krissi's Question, if I solved the Einstein-Podolsky-Rosen- Paradoxon, if there were no contradiction anymore, actually between the foundation of quantum theory and relativity - which is the real basis of the paradoxon as Bell made clear - h o w would that physics then look like.
Now I give you in a nutshell my vision :

it is the human brain that creates mathematics. Nowhere else is mathematics created.

In this creation by the human brain, we have many antecedent ones for citation, that the mathematicians created this.

Mathematics is part of the humanities, not of Science.

Today, we can also do something entirely new.

Of course: we can look into the brain.

And though I have no time to do it now, I do have a brain theory.

And of that brain theory follows, and that was actually the origin of my voyage to rediscover the c r u c i a l point of Gauss :

that Gauss' method of least squares I think I can deduce from the brain, from the visual cortex.

The visual cortex of the brain creates geometry. Helmholtz has said so, and in a way Descartes and Aristoteles said so, and I don't claim any priority, except :

we have in our time the possibility to look into the brain, into the Hubel-Wiesel-columns, the Ramon- y-Cajal-symmetries, I don't talk about today.

So the brain creates this method : and actually exactly t h a t method which I am using now to solve the Einstein-Podolsky-Rosen-Paradoxon.

Nobody had used it before !

From the brain's integration I can derive, and Carl Friedrich Gauss actually has said so, in the way the „in the thinking of the mathematician" and this is how the mathematician u n i f i e s the **laws** in the same way that we derive g e o m e t r y , in the same way we derive **errors** and the error formula and the symmetries we come to that.
And so the New Physics and Vision is as follows :

The Brain creates Mathematics. Its Visual Cortex has had its special place in the history of physics. The creation of geometry actually is variational there, and we know why, and that variation exceeds just numbers and geometry.

TRANSCRIPTION INCOMPLETE HERE !

Furthermore:

N o t h i n g in this brain has a n y knowledge about which kind of o b s e r v a t i o n we think about in this cortex ; we don't know whether we do it - by the eye or - by the ear or - by something else. or more particularly by - least squares - without the distinction of left and right - etc.

So sensation is not a priori, but only a posteriori to a unified mathematics.

By the ear, you will get my Music Theory, by the eye, we come - for i n s t a n c e - to geometry, and its critical v a r i a t i o n is very similar when - Aristoteles is writing, without touching the brain ; - Descartes is writing, in-a-way, t h i s time touching the brain in his „Traité de l'Homme"; and I don't go into that.

So we create from the brain the mathematical notion, and n o t h i n g of the - v i e w - p o i n t of the observer does play a n y rôle in the principle, how the brain is c r e a t i v e .

We find the same principle applies to be creative in music, and in other parts, the creation of brain's function.

So, now, with that p r i n c i p l e of the brain, which I assumed, we go in the mathematics and how the n e w view-point of the observer would see the clock but rather say :

t h i s clock should guide me through the Newtonian world, a n d should guide me through the Correspondence Principle in the Copenhagen Interpretation where we do something s p e c i a l with time which we do not do with the other observables :

we give it a special role

I think, that was my starting actually, that I can prove from the view-point of the brain, that the brain doesn't do that and does not put a priori as mechanics then did.

I don't know about the time there in the brain a priori.

So now we create t h a t paradox.

So now we go and we see that the same method of the least squares which creates the Gauss principle in error theory and which creates relativity and the action principle in general relativity, does create the entropy principle in Einstein's quantum theory.

And this was known by Boltzmann, and this does create the foundations, the two foundations of Einstein's physics, and with that we do the calculations and we do the creation of Gauss again today which was lost in oblivion but now does solve the EPR paradox.

And if then I do biophysics of nerve, synapse, catalysis, with that same kind of things, of the visual cortex' math of action, I go into interfaces.

I can easily show you by assuming the system of elements, that water is optimal with just that entropy principle, and the protons. I come to that easily, and I come to the theory of catalysis and nerve excitation which is not the subject today.

And I come to my unified theory of nerve excitation of membranes, which is not my subject today either.

And this was n e v e r before possible :

I come to a Round a Symmetry Argument which we cannot avoid which will give me a e x a c t results, given from the proper entropy in this field, of First Principles of the B r a i n .

We can discuss this only another time.

And this is exactly the kind of methods I use to create mathematics and to receive the results with Gauss.

This was when I realised: this is New.

I start from physics, from Einstein's physics, and I come until a brain theory with that unified physics.

It's all very nice. I finish.

This was the first part, of my Vision, it is exactly the place where I
create the mathematics with which I solve the
Einstein-Podolsky-Rosen-Paradoxon.

It is a matter of creation, sufficient to do this, what Gauss had done already.

TH:

What has done Gauss already ?

KK :

This comes now in the next part.

I now only say what I am going to prove today, and then comes Gauss' mathematics.

First Principle of the Brain. Exactly what of that I prove today

Exactly of that I prove today the equations of mathematics as Gauss has created it, and its rôle for the physics we have today, actually of a l l the physics we have today, the mathematical physics we have today, all the formula, basically, are in the scheme I presented.

And I'll exactly prove to you, w h e r e in Gauss' creation - which is since Descartes, Fermat, Leibniz the math up to today, where there was the place from Hamilton until the forms that we have today.

And then I tell you what I oblidged myself to, and I tell you e x a c t l y what is the place of E i n s t e i n .

Einstein was really very much after this principle. He has nowhere though seen this unity of Gauss, in his foundations of the way to approach the geometry worlds and the probability worlds, in any of the citations of Einstein I found. And I see that this solution of the Einstein-Podolsky-Rosen- Paradoxon is completely n e w .

We come to that.

Precisely the Place of Present Physics

Niels Bohr.

Niels Bohr's place in the picture will be the following:

Five years after Gauss did have this picture of the world, in 1829, there came Hamilton, and he made this wonderful specialisation of the picture.

He had also the general kind of geometry before the use of time and so on, and he then gave t i m e a special rôle. I do not go through the whole anthropology, there was also Lagrange, who, too, gave time a special rôle.

This has the wonderful advantage, first of all, to begin with our clocks. And then we can describe things. And Euler has shown how to derive differential equations from this variation, too, where time plays a special rôle.

And all-of-a-sudden, we can write the whole Newtonian mechanics, with the Poisson brackets, and all-of-a-sudden the whole h e a v e n of Newtonian worlds is at our disposition. to the principle of least action, which we t h o u g h t up since Leibniz just by our minds.

That is the history that was in the 18th century, the mathematical development, taken by Euler, and that is all we have today.

So this is what I prove today. So I go now to the place of Niels Bohr.

Bohr's place is exactly that, as everyone today does, as e v e r y o n e today does: even in general relativity, you take a special rôle, now of space-time, and of course Dirac, of course Einstein tried to do more, and to write the true action principle and so on.

They certainly have „sniffed" that the solution was somehow „before".

TH:

Can you concentrate on . . . You didn't say what Bohr's points was.

KK :

Yes. Bohr's point was exactly that the Hamiltonian approach, the s e l e c t i o n of time, and this was done for the Newtonian mechanics, and with Maxwell and so on in that time, to make Bohr's Copenhagen interpretation which says that, what Heisenberg has done which is equivalent to Schrödinger :

this is an a p r i o r i of our definition of reality.

The consequence is, of this selection of time, and the uncertainty between time and energy is a totally different thing then from the Heisenberg uncertainty betweem momentum and position, so with that c l a s s i c a l time it is an a priori.

So we have selected time in the first place, and measurement in general.

And we never leave this premiss again, and we live with the consequences, such as with the Einstein-Podolsky-Rosen-Paradoxon.

So this is Bohr's position.

Paul Dirac

in exactly what thereafter the place is of Einstein, Bohr, Dirac, Feynman:

Dirac was clearest to go beyond that interpretation.

Dirac clearly discovered the principle of least action must be the solution. He went back until Lagrange. This formulation is different, it is more general than the Hamiltonian formulation, but it s t i l l has the time with its special rôle.

I don't tell about more, because it is not crucial.

So he did not go to the very brain foundation, where time has no special rôle, despite being aware of the contact transformation which is in principle able to.

Richard Feynman.

Feynman rediscovered, before the 1950's already, 1942, Quantum Mechanics and the Principle of Least Action, and developed this beautiful unity of the form of quantum mechanics with . . . the field. This is quantum mechanics and the principle of least action, Richard Feynman. He had a 1941 paper already with Wheeler, and then later also, but this was . . . the crucial . . . principle of least action.

And he looked on it, and could n o t go before time.

„Time is what happens if nothing else happens."

And then happened something, which is very interesting in mathematics, which has happened to the Pythagoreens in antiquity, and which happened in any theory and which happens to us today :

Now we have this wonderful mathematics, which is exact, axiomatically closed, and applicable to physical systems which obey which only have to obey what we assumed, namely :

energy - time and their special place,

and then the consequences which are energy conservation and time-independence of law and so on.

Once we have done this, e v e r y t h i n g we then object like with eye-glasses, with mathematical eye-glasses, we project e v e r y t h i n g in this picture. And a l l the experiments which obey the assumption will be described c o r r e c t l y , and the paradoxes, which will n o t obey the assumption, will be mathematically t r a n s f o r m e d !

-

This is a key point.

We go through this, most beautifully, in Landau-Lifshitz, where the quantum mechanical theory of measurement is presented e x a c t l y in the form of the Einstein-Podolsky-Rosen-Paradoxon.

We go after this in the discussion period, go through as much as you wish.

So this is Dirac's form, and this is Feynman's form, and Landau's form, who had something exactly on the right side, but something that Gauss had they did n o t have; and Leibniz had it; he put it in terms of that „our world is the best of all possible worlds", meaning of course this kind of construction, also of the mathematics we have and of the experiments in Paris, Vienna, Copenhagen, Munich

And at the experiments, at the end, I will then therefore show :

If you take three view-points, and you take first Bohr's view-point, and you select time, then we cannot get rid of the paradox of Einstein-Podolsky-Rosen, but we can also say of course, the reality is like that,

we can even say it must be like this, we should not be so old-fashioned, we should have a more modern view. Since, we can correctly describe experiments done in that view.

That is all ok as long as we have no solution.

Einstein raised a warning finger : we shouldn't do so, although I didn't manage either to solve the paradoxon. Since, the paradoxon is untenable to any physicist who seriously takes notice of EPR. That is the second view.

And Gauss, the third observer of EPR experiments, if you take him out of the grave, and you have read everything he has written, . . . and we do that b e f o r e time, and he has also l e f t and r i g h t , which he compared to sour and sweet or things like that, which go beyond geometry's variations.

I finish my second part. So we know where I am today and where exactly the place is of the founders and pioneers in quantum mechanics. Not any one did start b e f o r e the schism in probability and geometry.

And we now start with Mathematics.

On the New and Old Mathematics

I hope I have shown you that mathematics i s created.

And I start with a citation from Gauss , which we have all in the power-point-presentation beautifully.

He did not tell people how he did it.

He was just the first to the people to correctly predict when Ceres will come back, the planetoid which was just discovered, and one could not know how this guy could make that.

And now we do the new mathematics.

If you look, how the creators of mathematics c r e a t e d mathematics, this is entirely different from anyone who a p p l i e s mathematics.

That is crucial. And that is the New view-point I want to introduce.

Which actually proves, that there is n o way forever, to solve the Einstein-Podolsky-Rosen-Paradoxon with general relativity as we have it, or with quantum mechanics as we have it.

Seventy years of no solution, and much better people have tried, and I say : we c a n n o t with the old mathematics.

The New Mathematics is created, and we specialise to geometry. And there is n o observable, no view-point of observation has a n y special rôle.

That is the number 1 .

How do Mathematics „while sleeping“ ?

And Math is also created in a way, where v a r i a t i o n is the first, and if you can later make differential equations out of it, all-the-time using Pythagoras and least squares, in both geometry and error calculus.

Now we can do this mathematics, and Gauss writes so to Gerling,

even „while sleeping“.

There are rare but dramatic formulations where Gauss explained how to use the method of least squares. He said : you know, you just a d d something, you just make it m o r e complicated, you add more things, and then, within these added things, when you v a r y , not only the fixed thing, also what you added

- and you see in Einstein's papers : he was aware of that ; and you wonder, why the hell does he do it, why does he need it like that, and you later see

so claim things which have no relation to measurement, just to how the brain works, and you make that into the say Hamiltonian function which is alright, you add this as a method of least squares, which is nothing but Pythagoras,

- blackboard writing

c square

and I show you later, if you observe the law of Pythagoras, and you observe

the least squares, it is n o t that

cc = aa + bb

the sum of the two cartesian squares, it is really that the square is l a r

g e r

cc > or = aa + bb

and it is only seen when

- drawing the triangle with variation of the hypothenusis

But this is only a limited variation, which does not e.g. introduce what is left and right, and so you can always in this class introduce left and right, and get to the whole chirality thing, and you get into other things, like singularities :

you make a point, say with inverse square law, and you know that you always live forever, until quantum electrodynamics, with this singularity. Only transformed.

You cannot get rid of it if you don't salvate it.

And the method which you create does nothing but to go into it. You can really not solve this by an equation . . . that you really go back before you create the paradox, before time, before the point of singularity, and you go really back to the method of least squares and avoid to create it.

And this is also so in Feynman's method : Calculating, not creating Gauss' form. Therefore, too, even Feynman could not solve the EPR paradoxon.

And now we ask:

how does Physics enter into such a New Mathematics ? such as how Gauss created it.

The only serious introduction into Gauss way to create mathematics is by reading and understanding Gauss' Werke, in the superior collection under Felix Klein's presence in Göttingen where even in mathematics nobody succeeded to conserve Gauss' unity in his own creation fully.

This has to be dealt with in another lecture on the basis of Gauss Werke

Band III, IV, V, accessible also via internet where I suggest volume IV
page 95 ff. for a begin, the partial English translation I shall provide
by then:

http://dz-srv1.sub.uni-goettingen.de/cache/toc/D38910.html

I instead just give you a little entertainment example of how Gauss created.

Gauss 5050

Just for entertainment, what we tell in Göttingen :

when Gauss was in school, he was X years old, the teacher gives the class an exercise.

Now sit down and add together all numbers between 1 and 100.

And everyone started to add 1 + 2 + 3 + 4 + 5 + and so on,

and before they really had started, little Gauss came with the solution :

5500.

TH : No.

KK : what?

TH : 5050.

KK : of course 5050. What did I say?

TH : 5500.

KK : you should not listen to what I say, you should listen to what I mean.

;-)

So what did he do?

He added 50 + 51 that's 101

Henrik Bohr :

49

KK :

49 + 52 is also 101

HB claims he added 49 + 51 that's 100

KK :

whatever you do, it is 5050.

HB and KK dispute how Gauss did it.

KK :

So we can quarrel about that, how Gauss did it

;-)

we wouldn't change the result.

Now Gauss proved that as Princeps Mathematicorum on the creation of probability and geometry worlds without which neither quantum theory nor general relativity could be formulated, and I only tell you what's relevant for Einstein-Podolsky-Rosen.

How Physics enters.

Physics of today enters due to others such as Lagrange, and I do not tell the history here. Lagrangians like Hamiltonians then are guiding everything into geometry's views and the principle of least action as we use it today, where in contrast to Gauss
t i m e has now a s p e c i a l rôle.

And later comes Boltzmann and by nothing but least action derives the law of entropy, throwing-out time again by integration. That's why Einstein's entropy-based quantum theory remained void of paradox.

And I only tell you how all did it, without the mathematical background, only the foundation of what all did, and I only want to make you aware of a crucial point I want you to understand, into which I invested time, a lot of time, after having to accept that the solution of the paradoxon had not been found by the founders :

why didn't t h e y do it ?

Remember from school time, and remember today, when you do a differential calculus, you do a lot of wonderful things, and some are greater in doing that, and some are not so, and Feynman

was the greatest, and everybody admires, that you do these things „while sleeping“ basically, you do it like this.

And you do it on ever higher levels.

So you are no more able to c r e a t e mathematics. You have to do it another way.

So something like this

- blackboard writing 1 + e^^i pi = 0

and my and Thomas' great teacher in Göttingen, Manfred Schroeder, calls it

„the most beautiful formula of number theory“, you write this down and ask

:

1 + e^^i pi = 0

Why is this so ?

And everybody drowns and cannot answer.

Why is it so? Ok, you may say, there is the Euler formula e^^i phi = cos phi + i sin phi and this you specialise. Ja, but w h y is that so ?

How does the pi come in ?

And John Hall did lecture here in Copenhagen and said : the wave guys push e and the optics guys push pi and then I said :

and the quantum guys push 1 .

1 + e^^i pi = 0

But w h y is that so ?

You go to Feynman-Hibbs Quantum Electrodynamics

and he collects all the most important formula of quantum statistics, and there is pi entering.

W h y is that so ?

e, pi and i all the time enters. Why the hell is it entering ? What is behind ?

We know the formula, we know the error law, but we do not know or we do not remember, never while we calculate, that Gauss' unity between geometry and probability worlds is behind and when we have a paradox at the foundation, we only t r a n s f o r m the paradox and never solve it.

It depends on the assumptions where it is made, the Einstein-Podolsky-Rosen-Paradoxon, too.

This is a very important insight.

So the full pleasure in doing the mathematics and enjoying it, is totally different from the pleasure of the paradox, which we can n o t solve with the old mathematics, we need a new mathematics.

So I think we start on the mathematical. side. And t h i s is the answer why n o b o d y could solve the paradox. Nobody started at the first beginning when trying to solve EPR.

Einstein w a s aware of that situation, I found one corrected handwritten manuscript that shows that he w a s aware . . .

http://www.alberteinstein.info/db/ViewImage.do?DocumentID=34310&Page=1

TH :

Could you say why they would not see the way to solve the paradox ?

KK :

The reason why nobody solved the paradox is because e v e r y b o d y did n o t create a mathematics b e f o r e the paradox assumption had been made.

Thomas Heimburg :

And what is the paradox assumption ?

KK :

That time has a special rôle. That the view-point of the observer has a prior rôle.

This is neither so in the brain, this is neither so somewhere else, it is up to our free decision, to take our time or space-time in general relativity, and give it a special rôle.

Why nobody could solve the paradox.

Time has nothing to do with rotating universes, where we get time travels back to our birth, time is not dominant, we have many other effects.

But time, that is the one which we select : with Lagrange, with Hamilton,

with all of them

Gauss criticised Lagrange for his

„schielende Darstellung“

a representation side-tracked by facing something else

and no one did achieve Gauss' unity in the twentieth century. Maybe they did not know it, they could long have had EPR solved.

Dirac was clearly on the way, he could though n o t do it before the Lagrangian. Dirac had this great paper 1932 from Russia, going back b e f o r e Hamilton, till Lagrange, we can discuss this as long as you wish after :

not anyone did go before the assumption of time as far as I know, before the arbitrary introduction of a prior view-point on Gauss' unity.

But then the question is: how do we c r e a t e d the new mathematics ?

How do we relate the solution of the paradox to all this great work which could n o t solve EPR ?

Figures at the Blackboard.

I tell you p r e c i s e l y , how the brain's more general way to do it,
or Gauss' more general way to do it, getting from brain his least squares,
which have no idea what time is, how by this special relation when we make
the variation, you know, a variation where I do not know where I started
it, no a priori observable, a variation
at the blackboard - Pythagoras' triangle with varied hypothenusis - Gauss'

error law w i t h least squares

where this straight should be equal - Pythagoras law - Error law, a variation where I originate the law before law, D I ds and there is this variational principle in which we write this law today, and this is all ok. And I do not know what I am talking about in terms of observation and where with the variation I define the straight, before, it is not yet a feasible state, not yet seen from the view-point of the observer.

And then you say out of habit :

I want t i m e ,

please !

blackboard - Lagrangian, Hamiltonian, variational principle of mechanics

The brain doesn't know about it. We do it at will. The brain does e x a c t l y the same thing in a n y other thing as we do it especially here with time. Therefore, this selection creates a paradox preventing unification.

And then we can introduce all these nice numbers, no question, and we can

talk about it, what I here put

blackboard - Descartes - geometry - numbers - 1 + e^^i pi = 0 etc.

but w h i c h number, for w h i c h observable? which view-point is rendering others paradox?

W e do that selection for our preference, or habit, not for the law before law.

And when we now vary, e.g. with the Lagrangian, we do that a little
different from the Hamiltonian where we do that for open systems, for that
Hamiltonian, it has a little bit a different meaning,
and then, with Euler, we continue until the differential equations, with

the Poisson bracket, and with Heisenberg's form

and we continue to transform the still same paradox.

That we do, and we do it with mathematics, everybody did it with
mathematics, and we can do it better than with the Hamiltonian, we can do
all that, but

n o b o d y

went before the Lagrangian, nobody went till Gauss or even before, and n o n e went back to the origin of the then new mathematics, Many did invent mathematics, but no one did with the original variation void of view-point, when trying to solve EPR.

I'll give you nothing of that here in my talk. Maybe you find more of those truths than I did by reading our pioneers, Aristoteles, Descartes, Leibniz, Lagrange, Gauss, and then Boltzmann, Helmholtz, Planck, Einstein, Bohr, deBroglie, Heisenberg, Schrödinger, Pauli, Dirac, Landau, Wheeler, Feynman, Bohm, Bell, Penrose etc.

Here we are, and I should end with mathematics, yet I m a d e it.

That's where we are, and all the others, you can ask me on each author, Gordon Baym's wonderful text book, not only in Copenhagen popular, we had it when I studied in Stuttgart, when I did my PhD in theoretical physics :

the greatest formulation, it's Feynman who did it.

But the Einstein-Podolsky-Rosen paradoxon is t r a n s f o r m e d

by even the Greatest. It is tranformed by Feyman and Hibbs as it is by Landau and Lifshitz.

So that's where we are, and I finished.

We come now to my solution of the paradox.

My solution of the paradoxon

And I assume now, that we all are in the mood of c r e a t i n g mathematics. We all are in the mood of absolute certainty, that a f t e r having introduced the paradox assumption, the paradox assumption of the time e.g., of view-points as you know, I give you an example which is equivalent to EPR, which is used many times and is alike it.

Two men at Roma airport are waiting for their flight.

And someone is coming and distributes two handkerchiefs. The one is white, the other one is red. Anyone of the two knows: we have only two handkerchiefs, but he doesn't know which one he gets. The one gets the one handkerchief, the other one gets the other handkerchief. Reminding „Bertlmann's socks" of John Bell.

The one goes to an airplane to Tokyo. The other one goes to an airplane to Chicago.

When the flight arrives in Chicago, he makes a measurement. He takes out the handkechief, and he realises:

it is white.

Now he makes the premiss of time, the whole apparatus of time a priori, of time-space, or the reduction of the reality by measurement, and comes to the conclusion:

the fact that I have observed here white must be t e l e p o r t e d over to T o k y o .

The conclusion is:

I am now after 1993 Bennett et al. Alice, and I tell now Bob this information.

And indeed, h e observes „red“ in Tokyo as predicted. So the theory is „correct“. It is obviously „incomplete“.

There are many examples of that kind. This other one I shall also tell, because I invented it, in the year 2005 in Vienna, and this makes a kind of translation for a n y wave-matter reality.

This became known as the Shakespeare paradoxon.

Imagine a Universe.of spherical symmetry, actually an aula of cosmic dimension and spherical symmetry.

This aula has wall of also cosmic dimension and spherical symmetry. In this wall are two slits. The double-slit experiment.

There are two slits of cosmic distance, and at these two slits, behind, are two observers, too remote to communicate, even not by light.

So, now in the symmetry center of this universe stands Ha m l e t and he

says „to

b e ! „

And he speaks loud enough, and the sensory instruments behind the wall are
sensitive enough, and these are acoustical things without quantum mechanics
now,
so the observer 1 can now detect, and measures the information „be !“

Now if we adopt the „time a priori“ interpretation, which goes into our present interpretation of our quantum mechanics, in the interpretation of the Einstein-Podolsky-Rosen-experiment, and puts it ad absurdum, then we must conclude:

the one observer, who has the information „be“ does t e l e p o r t this information to the other observer at the other end of the universe.

So instead of the obvious symmetry one now concludes that teleportation is the reason why, at exactly the same point in time, the remote observer, too, receives the information „be !“

So you can do the EPR paradox with a n y t h i n g in this classical case of waves already.

And this has been accepted to be paradox by a l l pioneers. I brought for you here the last discussion of Niels Bohr, with Thomas Kuhn, to which we listen after, and which has never been published so far.

Thomas Heimburg:

We probably agree that this handkerchief thing is not a paradox.

KK :

Oh, but this is the Aspect experiment. Everybody has accepted that this is something on the Einstein-Podolsky-Rosen. And the whole thing was done by Clauser . . .

TH :

That is exactly what we have to find out, whether this is the same thing or not.

This one thing is n o t a paradox.

KK :

Now we debate it. I also say : it is n o t a paradox.

TH :

So why do you think it i s a paradox ?

KK :

I say: the paradox is the introduction of time a priori.

TH :

But what does this have to do with time ?

KK :

I say, I tell you: if I do it, even if it has nothing to do with quantum mechanics, I am forced to see it as teleportation. Because, how else ? If at this very instant „t“ this guy is measuring „be“

and is predicting, according to this interpretation, that at this very moment, with super-light instantaneous and infinite velocity, this information m u s t arrive at the other observer.

It is the paradox that is in this a s s u m p t i o n .

TH :

But the paradox . . . there is no paradox.

Henrik Bohr (HB) :

No, Thomas, what you wanted to say:

t w o types of paradox, there are t w o versions here. One is where they just use a b s o l u t e conservation of t o t a l momentum, and this is when you take the two handkerchiefs, and one takes them, and finds out in a hotel room in New York, that it’s the blue one, then the other one must be red.

And this is nothing like a mysterious long-range-forces which between New York, and the other . . .

KK :

I say, this is true for a n y of the experiments,

in Paris, Vienna, Copenhagen, Munich.

It is so in a n y of the experiments on quantum teleportation.

HB :

So I think the whole thing comes in, when you for instance have some filter or something, where you can see this colour say red and then the other one white.

And this is the case when you have a Stern-Gerlach magnet . . .

KK :

Jaa !

HB :

and you see the one polarisation say in New York, and the other one has gone to Tokyo, then the other one must be pointed down in minus z of the z-axis and you are oblidged to see something.

KK :

This is a very good point to make. And let me summarise all the experiments while you mentioned the c o n s e r v a t i o n law.

Actually, even the Einstein-Podolsky-Rosen-Paradox, I have not seen it so far that anybody speaks about it, but it is o b v i o u s , to really point t h a t out :

you get the teleportation of the momentum, when you decided to do the momentum measurement, and now to have a precise momentum t h e r e , and n o t h i n g but the c o n s e r v a t i o n law is making that h e r e the momentum is now given, too.

Quantum theory does not touch it.

You have a total law. I have a total momentum before the collision, I have
a total momentum after the collision, I make the measurement there, where
the momentum has a precision now,
it is a consequence of the conservation law that the measurement must be precise here, too, no matter how remote, with predictable value observed.

You are v e r y right !

HB :

Wait, wait. The basic equality is right. Ok. There is actually a certain range of final . . . which you cannot . . .

Then the conclusion would be :

the equation is right.

KK :

Jaja !

HB :

Absolute. The momentum is not conserved . . .

KK :

. . . the t o t a l momentum is conserved . . . but not that in our Hamiltonian for one particle . . .

HB :

. . . that's why I say, I'm not afraid of, I am very rude, I say that it's o u r problem. It's o u r interpretation, and you try to . . . It is not physics, that is wrong here, ok,. . . .

KK :

Yes, and now this is our point, and also Thomas' point :

is it a paradox, or is it not a paradox ?

I go away from EPR, I go away from anything, I just take the old antique Science and Philosophy, that starts with the paradox.

We wonder !

If we never wonder, it never comes to physics.

So it starts with the paradox. So h o w should I formulate if someone comes and s o l v e s the paradox ?

The s o l u t i o n of the paradox, any fundamental say as our Newton solution for Halley's comet, has a l w a y s been from an inexpected, entirely different, and I would say c r e a t i v e side, just something else.

In special relativity:

w a t c h the clock !

So it is just related to „watch the clock". Just something „else" comes in.

And then we have the situation: the paradox is „solved".

Now you have different ways to speak about it. The one will say : I „solved" the paradox. He talks to them who still think the old way.

TH :

Konrad, I still want to say something. The handkerchief thing. Because I don't understand the point of that.

As far as I understand, the Copenhagen Interpretation basically says

this is what Einstein and actually also Schrödinger addresses :

it says : it is not really d e c i d e d whether the handkerchief is white or red, until you look at it. Ja ?

So, now y o u haven't solved that paradox either. You don't know, whether the handkerchief was red or white before you looked at it.

KK :

But I say : this is the wrong view-point ! This is not the solution.

Relativity proves the wrong view-point, . . .

TH : Why is it the wrong view-point ?

KK :

This is the wrong view-point to say: in the m e a s u r e m e n t it will be decided.

You say : it has long been decided that the one is white and the other is red.

So we stop that. We take the conservation law, and the measurement is the consequence of this long-decided thing.

And not . . .

TH :

. . . but the Copenhagen interpretation or let's say

Einstein-Podolsky-Rosen is something that adresses exactly that relation, and the quantum theory, and then you say what Einstein was saying is in relation to Einstein's theories, then it comes to a paradox.

So, Einstein didn't solve that, and he just said there are contradictions, and therefore we cannot think it is complete.

KK :

No, I come to that, where we are now.

TH :

But y o u have this point . . .

KK :

. . . I will write it down now . . .

TH :

. . . but you . . .

HB : no . . .

Clive Ellegaard (CE):

The example which you choose is not good because : You can c h e c k during the whole flight, which you never can when you falsify it. You can do the measurement wherever you want . . .

HB : . . . but then you destroy the final point . . .

KK :

. . . that is a point for the special relativity, but for the i n t e r n

a l story of quantum reductio ad absurdum of the revival of EPR measurements since 1982, or even before, it was done and is really, as you put it out, in high sophistication observed, but the observation is

n o t to the point.

There is no teleportation, just conservation law.

It is true, that the spin itself has no rôle in the EPR. There is no spin. But it is also true, that Dirac immediately checked for the spin and he has shown that for the spin also . . . and therefore he came to Niels Bohr and he said:

we have to do it all over again. It doesn't work. Einstein proved it wrong.

But it is true, that nobody could solve EPR.

Now, at many experiments, when I reacted in Vienna to a l l the experiments, and you know, i f you are in the field and you know the whole thing, and you have done your thesis on lasers, so you can follow somehow these things, then you realise :

y e s

it is true, and you confirm quantum mechanics, and it is all wonderful :

but it is

n o t to the point ! It has nothing to do with Einstein-Podolsky-Rosen.

Meaning, that many of the experiments, which have been done, and have been

concluded to decide against Einstein, have

not been to the point !

The experiments have a d d e d something, such as in Vienna where e.g. you have quantisation in the horizontal orientation, and classical in the vertical, or teleportation across the Danube in a tunnel or around the globe in 2005 over many 100 kilometers;

there are phantastic things you can do today :

you have a d d e d things on top of the paradox, just by applying refined

mathematics or methods here, and you only

t r a n s f o r m

the paradox.

TH :

But is your statement now that the uncertainty relation is not right ?

KK :

I say:

the uncertainty relation is o n l y right if I have chosen t i m e a priori. And I limit my world - that's what I call „reduction" in my text, if I „reduce" my world view to a world view - although I learn I can do much more - and Niels Bohr has predicted 1928 that the brain should play a rôle -
I reduce my world to o n l y worlds where I can have a c l o c k , a

four-dimensional space-time-clock, and have

s o m e t h i n g selected out,

which will stay forever selected out, and I will live forever with the

paradoxes thus created

this is the free decision of mine that has it c r e a t e d ! Schrödinger 1935 spelled out most of it.

That's what I think answers your question.

And at the f o u n d a t i o n we see it from the Como Lecture of Niels Bohr, I have it all here in my book exhibition on the table where you see :

they were all aware of ! of the problem, not the solution.

You had to do this time-energy thing first, and if you do it first a priori, it is paradox.

Even Immanuel Kant had in his Critiques of Pure Reason to do that, on Time and Space, he could not arrive in his Transcendental Analytics at Time and Space as conditions, he had to do that separately, you see it all-the-time, it is a view-point that has to be a posteriori. Even Kant was wrong there.

Gauss did not agree with Kant at all.

But Aristoteles, he is different, as Descartes, just as Dirac's contact transformations, we can go through the whole thing, it is always the same thing. There is no paradox in their way.

And then the t i m e comes l a t e r by making a rhythm into the motion in eternity.

chronos arithmos kineseos aionos. chronological time as the rhythm moving in eternity. This is l a t e r , it is always later.

And then we are successful and have created by this mathematics which beautifully fits to the experiments, where we h a v e a clock, and where we h a v e the consequent energy conservation law because we c l o s e that system, and the quantum of action looks like a quantum of energy, only then,
and once we have that premiss in both theory and in our way to do and to interprete the observation, we eventually turn blind even to the falsification in EPR by reductio ad absurdum.

We get used to it just as if time were indeed a priori . . .

Henrik Bohr :

May I just say: it's fine that you hit on the uncertainty relation, but the uncertainty relation, this is only a problem when you have g i v e n it the interpretation.

The uncertainty relation as such is only a mathematical . . .

KK :

. . . ja . . .

HB :

. . . it is only a mathematical equality of the wave-packet . . .

KK :

. . . as Heisenberg 1927 . . .

HB :

. . . you just say : a wave packet, and then you can see these elementary things that there is, I mean, . . .

KK :

. . . very true, that is how your grand-father has put it in the Como-Lecture . . .

HB :

. . .

KK :

. . . ok, you put the uncertainty relation for energy and time by a special argument that time is prior and then you l a t e r come with the Heisenberg form.

You are completely right.

Dirac had the contact transformation. He w a n t s to get back to this mathematical relation. You are completely right !

And the uncertainty, that is an uncertainty that is valid for a n y wave ! And no wave whatsoever and so no matter has a n y reality at a point in t i m e ! !

And I solve the paradox by just pointing out where the e r r o r is, it is a human view-point where the error is, t h a t was it, and if one takes the other view-point, there is no paradox.

And then you can infinitely debate it whether it is a paradox or not.

The error is this:

for phenomena a priori, time is a condition and not a mode, and their reality is then to be a reality at any point in time.

It's all wrong !

TH :

So how should I then imagine reality without time ?

KK :

Yes ! You do it like Gauss ! You start to see the liberty to create mathematics. And to put all physics and view-points of observation later.

And you c r e a t e the possibility to have some later view-point or not

and then you look which view-point will fit least squares for the u n i f i c a t i o n .

I say; we have all chance - I come back to this in my conclusion - we have the real chance of re - unification in physics.

The cosmos does obey the entropy law, of the microwave background, the

living does obey the entropy's action, of the aqueous interfaces,

we go back to the c r e a t i o n of math, cosmos, and life.

We project these things to our mind - and Einstein says it at the beginning of EPR 1935 - ok, but it is w e who project it into our mind, sometimes with, sometimes without paradox-creating a priori.

and it is a great mystery that our mind is able to unify and to develop this with all these . . .new things and all these new measurements and eventually with the new mathematics void of paradox.

We are capable to do m u c h more than we have learned to do

and we have a l l the philosophers and all the creators.

The s p e c i a l view-point of our days, the f a s h i o n of today was
that some specialists have thought some special things are the f i r s t of
our condition

- for the nerve's impulses thought the electrodes are the first condition - for life's catalysis that rates were ar the origin which they are not either, - for wave-particles again time a priori, the view-points put methods prior to the unifying law which, following-up Gauss, is the action of entropy.

View-points are „schielend", of interest due to our methods. Nature does not care. about our limited view-point. which is never a priori and in the solution of the paradoxes thus created the view-point always had turned a posteriori, to the regret of the generations who had accoustomed to it.

This is our History of Science.

To generalise, and our brain is capable to create new mathematics again, we generalise this, there is nothing in nature which knows a n y t h i n g what we humans choose to do with t i m e a priori, and then the things we do with the paradoxes resulting.

TH :

Let me ask, just to get it :

I can easily see, that certain problems come into physics because we are

projecting on certain axes, for instance time and also space,

but I nevertheless don't get why you, by just s t a t i n g that, think you solved the Einstein-Podolsky-Rosen-paradox.

KK :

That is the s o l u t i o n .

If you don't see it, you have it, if you see it, you don't have it.

You even argue, that it is no paradox, in other cases, too, where you see the solution.

I prove you that you will never solve it, on the old mathematics.

TH :

. . . ja but I mean . . .

KK :

. . . it is the solution. The solution is that this is not a fact of the world. It is our calculus after a false premiss.

TH :

. . . ok . . . ;-)

KK :

Yes, Holger now . . .

Holger Bech Nielsen (HBN) :

I am certain, and I perhaps check if I am understanding your point-of-view.

That your are in-a-way, I also understood, that you are a d v i s i n g us to f o r g e t time.

Because . . .

KK :

. . . I later . . .

HBN :

. . . because you are forgetting time . . .

KK :

. . . no . . .

HBN :

. . .

KK :

. . . I forget y o u . . .

;-) amusement in the audience

but I am creating a new world without you

;-)

HBN :

. . . I could see what you say, at least logically I could see that if you
have, if you n e g l e c t that there is time at all, then the whole point
of the Einstein-Podolsky-Rosen paper, then this point is down, because,
it is clear, that when you talk about reality, it is reality of some call it „phantasy-world“ which is
what exists at one moment of time.

And if you ignore this kind of prejudice, of mathematics, or what you call
it, that you h a v e a time, then of course you get rid of that and there
is nothing special about the guy taking up his handkerchief and they are
all getting in other cities,
because it doesn’t matter

because they are not selected, because the concept of time has been killed already.

Of course Einstein was the one to do that himself by accident . . .

Henrik Bohr :

. . . nono nono, because this is . . . small differences, I mean . . .

HBN :

. . . ja, ja, very good, now I go further and I say that we should f i l l this . . .

KK :

. . . but now I'm doing more . . .

HBN :

. . . aha . . .

KK :

now that I have killed time and I have no more paradox, and now I . . .

HBN :

. . . that is the Einstein case . . .

KK :

. . .

HBN :

. . . now - can you r e c r e a t e the Einstein-Podolsky-Rosen-paradox in a formulation where you don't have this time concept in ? I don't know, but I think you should do that. I think t h a t would be nice to try.

KK :

Yes. I have it.

Now, once we are rid of the erroneous hypothesis, the we have a basis to restart.

HBN :

. . . time without a paradox . . .

KK :

. . . we . . .

HBN :

. . . now comes the problem . . .

KK :

. . .

HB :

Now I attack you on the problem :

You, in your o t h e r theories, about e n z y m e s and so, you have u s e d time, because you say that our time is really enzyme time. We are aging or we are not aging, I mean, this is way-off the question.

Therefore, t h a t is what you are doing. You are constantly creating time by these enzymes and then . . .

TH :

. . . we shouldn't start this . . .

HB :

. . . and then the same enzymes, say, we go there, and we go there, and then there is a time . . .

KK :

. . . now I go and answer this attack. Both of you (Holger Bech and Henrik)

When I have omitted time, I don't have time, I got rid of a n y view-point
of the observables, of eyes, of ears, of nose, and anything is gone, just
call it
math

and t h e n I recreate - the physics as we have it - and the physics where
there is no paradox - and maybe slowly the physics that we will have in
hundred years
and there I recreated t i m e to precisely the point that the Einstein-Podolsky-Rosen-paradox is r e c r e a t e d !

at least in t h i s world, in t h i s chosen view-point.

I do this in another way. By the Gauss solution to the Einstein-Bohr-controversy.

TH :

Konny, you should come to the conclusion.

KK :

Ja, I wanted to do the conclusion now, but this discussion is very important. But that's ok.

And then I come to the enzyme theory.

I create enzyme a c t i o n w i t h o u t time !

TH : . . . conclusion . . .

KK :

jaja, Einstein did the fluctuation-dissipation, so I do the fluctuation-rate . . .

HB :

. . .

TH :

. . . I also want to make a point:

if you get rid of time, you also get rid of space, right ? You get rid of the concept of reality in a certain way.

I cannot really imagine . . .

KK :

. . . I give you a more proper formulation. „Time“ was actually a more „catchy“ formulation.

The point at the foundation is that

a n y view-point, a n y observable, any view-point whatever,

you can n e v e r place it at the b e g i n n i n g .

You have to place it l a t e r , a f t e r you have avoided the paradoxon, and n o t h i n g of the argument I make is specific about time !

You are right, it is also true for space.

We can do four-dimensional things, and then do the symmetries of the brain

cortex relations,

TH : . . . not now . . .

KK :

. . . one can do all that

but nothing of my argument is specific to time.

Time is the most catchy thing, it’s the one which has the history of our mathematics in physics so much dominated, more than anything else.

That is the only historical and psychological if you will reason why time has become so crucial . .

We only take it a posteriori and everything is solved following e.g. Gauss.

I can keep time, too.

And I come to time in my enzyme theory in the following way :

I start from entropy, which does n o t know about time !

Time there is only historically where it started before Boltzmann.

And I do what Einstein did in all his statistical physics, namely :

to create the view-point of the observer with the clock and make these

averages, to get the fluctuation-dissipation theorem,

which for just time observable brings me to enzyme kinetics. Enzymes create time only a posteriori, like Einstein in the theory of Brownian motion and diffusion.

There is no prior time in the fluctuation law, in the moments. This is only after . . .

HB :

. . . because I mention this, this is the only way I can really see that

time is nonlinear, because you can also have decay processes and so on

but they are not absolute . . .

in a way enzyme is very absolute, and that is also why . . . you can do

chemistry . . . and so on . . . and then you have time again,

but an enzyme, the function of an enzyme, can actually make the protons tunnel and so on . . .

but the enzyme itself is not tunnelling the enzyme itself . . .

TH :

I don't see the enzyme case is a paradoxical case . .

HB :

nono, I will not . . . I will say certainly, that the enzyme has a specific time. Time has a meaning there. Time is a reality there.

I would say.

About decays also. But this is one decay here, and you never . . . ok time has . . . in decay it's not like enzymes where you have so much time I mean, it's additive and it has all these things that . . .

KK :

I give you now . . .

TH :

urges for conclusion

KK :

I think this is a good point to give at least formally my conclusional

remark on the vision for the unified physics

where we can place this, enzymes, EPR, time . . . e x a c t l y .

The unified physics I for the moment start as far back as Gauss put it.

Having in mind, being well-aware that we have - in music a different variation from - vision and math - or smell and tast but in all we have the unifying principle of Least Action in the brain .

which I claim to have established in my brain theory observably.

Then I see, that the Einstein-Podolsky-Rosen paradox is solved by Gauss' math as created in the brain, and it disappears already by simply putting time a p o s t e r i o r i .

The clock has nothing to do with the reality of these whole phenomena.

So I just must not conclude from Alice's measurement that she has telecommunicated to Bob. This is a very different thing.

So now I go to biology and ask : Where is the Origin of Life ?

What does it mean when I say: we look at this catalysis and single enzymes and we see :

they are in Brownian m o t i o n , even the reaction coordinate is in Brownian motion, and in Brownian motion these guys have n o idea what time is !

They simply don't know.

They wouldn't get the moments from time-views, they have no idea what time is. They get it from entropy.

And I come with the time a posteriori and now we can average, and I get the fluctuation-dissipation theorem, alike another clock.

And this is my way, in conclusion,

and then I see that the enzyme ist just in Brownian motion and of course at surfaces and there a lot of critical specificities, no lock-key-paradox, rather pK's critical states creating both specificity a n d efficinecy.

And then I go to nerve, and then I see also the same channel-like noise in enzymes as in synaptic and action potentials, seen by Rigler 1999 or Neher-Sakmann 1976, respectively;

and then I go to the brain principles by exact symmetry arguments.

TH :

Would you say,

what you say is a little bit comparable to the „cave-paradox" where you see
the projections of reality and you construct reality from that but you only
see a certain part only a projection of it and that doesn't really recreate reality. So you arrive at the paradox in fact, but, if you look at it from all sides, it is no paradox.

Is this about what you want to say ?

KK :

This is in the middle of the Platon-Aristoteles dispute, and I can place this dispute precisely.

I place it in the Platonian view, extremely, Platon of course was aware ot

this junction,

but let's put it extremely :

Platon had the theory of the „ideas" „eidos", that had nothing to do with the reality and where we can pick-up"things" and even the „world" in the dialogue Timaios.

And then comes Aristoteles and says :

Yes, that's all fine and nice, and adds all the logics and all the things

to decide what is „true" and „false"

and then we must do the

m e a s u r e m e n t !

And that is where we come to reality with view-points and paradoxes.

And there we come to physics, and there we come to time-space, and so on.

So, let's put these two extremes in the vision of the new physics, it is exactly the following :

the so-called Platonian position, which is also the position given to

Heisenberg, the Platonian position is

b r a i n t h e o r y ! ! ! ! ! ! !

Brain cortex pure !

And Aristoteles is saying :

use your brain to observe the world ! Use your senses, too, a posteriori as I add.

And also use your brain to create mathematics and to do something which is logic logics and syllogistics and with the Gödel-Zeno paradox and all these things that I s o l v e in my brain theory !

and make all these things as good as you can to judge what you think about this world.

And this is what Einstein said in the Introduction to the
Einstein-Podolsky-Rosen-Paradoxon 1935 and that is exactly what my brain
theory explains

HB :

. . . these things . . . rose . . . by the other . . .

. . .

KK:

nono nono

this is the point:

it is the b r a i n .

We care about the brain. We care about sensory organs. And then we care about the way how we think about.

And we have the funny ability to do something limitedly that unifies . . .

HB :

. . . say that time is a construction and that's what we were trying to argue before, that ime is not just a construction . . .

TH :

. . . I don't argue that. I can think it is a construction.

But I have a hard time to imagine what in physcis we would do w i t h o u t such a time . . .

HB :

. . . but it's not only that . . .

KK :

. . may I cite Einstein as quoted by Forsee, here in the Wheeler-Zurek :

„time and space are modes by which we think and not conditions in which we

live"

to repeat:

„time and space are modes by which we think and not conditions in which we

live"

And I say in addition :

we m u s t not even think in these modes.

But this is where we turn the

modes in reality by which we think awaz from conditions by which we create unsolvable paradoxes.

Jens Bang (JB) :

What are these conditions ?

KK :

That is exactly the discussion. That it was made for.

JB :

But of course there is time and space . . .

KK :

Yes, sure. But this is ok. We can always s a y this is the condition in which we live.

From this moment on we limit ourselves to the world which we can live in

with the time, with the clocks and which is the world of today's physics,

and we t r a n s f o r m the paradox as I have described, and we live with the transformation, and we say the reality is we have to adapt to this thing,
but we have to adapt also to these minds where this is a priori, and this is ok.

We do this in all history in the dabate on physics philosophy.

TH :

What do you say what the clock is exactly doing ?

KK :

What you are doing, what anything is doing, something which I try to understand.

And if I measure a clock and if I take first of all a pendulum and I try to see what I do with time really:

If I don't care about it, then I just c o u n t .

1 2 3 4 5 seconds.

I take it as a counter, I don't care.

Schrödinger in his „What is Life ?" is doing the e n t r o p y of c l o c k s !

Sure ! of course, there is entropy. and . . . . that is all the same lesson :

w a t c h the clock, in quantum theory as in relativity.

And then is the question :

How far do we get ?

And can we live with the Einstein-Podolsky-Rosen-Paradoxon ? Or can we not

?

;-)

amusement in the audience

;-)

And this is also done in these measurements on Quantum Information on a very high level of sophistication.

And that is what Niels Bohr had p r o p o s e d in all these discussion, and then in 1927 at the Solvay Conference, and then in 1928 Bohr predicted that the b r a i n has something to do with the answer.

And this prediction of Niels Bohr I confirm on the deepest level I am capable of.

Ja, Holger !

Holger Bech Nielsen (HBN) :

I think you are right in the way that

if you . . . that assumption in that mode that I have when I read

Einstein-Podolsky-Rosen, a l l information in a so-called „complete“ theory

I mean there is the counter-part to a complete theory, the concept, that is introduced by - or it is not introduced - a thought-up on . . .

then you think

A LONG DISCUSSION WITH HOLGER BECH IS STILL MISSING TRANSCRIPTION

. . . . . .

KK :

I can very much support what you say.

If you read the old literature, and I start with Boltzmann, if you do this statistics and you do it with time, you will always find, that the term t i m e is not at all used in connection with the c l o c k .

Read carefully, read between the lines, then t i m e is something where I
have something and then something and then something

and if I connect t h i s now and I see the true statistics, I did not know about the clock, didn’t I ?

And now I come back to my approach to a unified theory of it all y o u will say whether I have it.

If I go to a different start from brain theory, I even from today’s physics
can prove but I only take the experiments in the unifying cortices

invariant for all sensory specificities,
I see

t h r e e

principles there when I derive structure and function without assumptions,
I derive brain theory from physics' least action there, in the cortex
networks,
and these three principle I find are contradictory -

I call them c r e a t i v e and I call them

A n d O r N o t

I can tell you :

If I start from these principles of brain action, I can formally put it in Gauss' way as we would like to do, to see also what the brain is doing.

But I tell you a difference that is ubiquitous !

There is inhibition O r , where the differences are there to distinct.

There is then association A n d , where we put all together again till
unity. And there is an ignorance N o t of us where we ignore most things
but not others,
and there I can c r e a t e time !

With Mitchell Feigenbaum I had a great discussion on that.

I can create time in the same way as where I create anything. There is a creation of time in the same meaning as where I create anything.

And n o w , and n o w , and even another point, and so on, and we just do it and connect something with something.

Thomas Heimburg

Maybe I should declare this talk for coming to an end, to the end.

THE END

Konrad Kaufmann

Do you still want to see a few pictures without explanation ?

And listen to Niels Bohr's discussion with Thomas Kuhn ?.

1.

Here you see Feynman in the round at Princeton. There you see Oppenheimer
and everyone in a Round in-a-way where you see very nicely the rôle
mathematics has to socialise in calculating

2.

and you are able also to create mathematics. And the way how you c r e a t e mathematics is rather in the next picture, Richard Feynman and Paul Dirac, from a Physics Today cover in the early 1950's.

3.

Einstein's handwriting to the editor of Physical Review on publication

and twenty more illustrations to the solution of the
Einstein-Podolsky-Rosen-Paradoxon.

And finally, we listened to the last tape of Niels Bohr from the day before he died, and where he is interviewed by Thomas Kuhn on the positions of Einstein, Dirac, Planck, Heisenberg, and himself, and all was about the Einstein-Podolsky-Rosen-Paradoxon.