**Vienna physicists double-down on their pseudoscience**

Hartmut Lemmel from the Vienna University of Technology

has responded to my email questioning their conclusions.

To make it more readable, I used to following system:

1) Their original article in italics = ORIGINAL ARTICLE

2) My email reply in bold = MY REPLY TO ARTICLE

3) Hartmut Lemmel's response in italics = THEIR DEFENSE OF ARTICLE

4) My second set of replies in bold = MY REPLY TO THEIR DEFENSE

 (I won’t be sending the second email – but if I did, below are my responses)

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**ORIGINAL ARTICLE**

**One particle on two paths:**

**Quantum physics is right**

**from**

**The Vienna University of Technology**

[**https://www.sciencedaily.com/releases/2022/05/220511123554.htm**](https://www.sciencedaily.com/releases/2022/05/220511123554.htm)

*The double-slit experiment is the most famous and probably the most important experiment in quantum physics: individual particles are shot at a wall with two openings, behind which a detector measures where the particles arrive. This shows that the particles do not move along a very specific path, as is known from classical objects, but along several paths simultaneously: each individual particle passes through both the left and the right opening.*

**MY REPLY TO ARTICLE**

**And yet, when detectors are placed in each opening,**

**no double-slit experiment has ever detected**

**a particle passing through both openings simultaneously.**

[**https://en.wikipedia.org/wiki/Double-slit\_experiment**](https://en.wikipedia.org/wiki/Double-slit_experiment)

**“... *versions of the experiment that include detectors at the slits***

***find that each detected photon passes through one slit***

***(as would a classical particle),***

***and not through both slits (as would a wave)*.”**

**THEIR DEFENSE OF ARTICLE**

*Normally, however, this can only be proven by carrying out the experiment over and over again and evaluating the results of many particle detections at the end.*

*At TU Wien, it has now been possible to develop a new variant of such a two-way interference experiment that can correct this flaw: A single neutron is measured at a specific position -- and due to the sophisticated measurement setup, this single measurement proofs already that the particle moved along two different paths at the same time.*

**MY REPLY TO THEIR DEFENSE**

**You don't explain how measuring a neutron at a specific position**

**proves that it traveled along 2 different paths simultaneously.**

**You have simply asserted it.**

**MY REPLY TO ARTICLE**

**If you have 2 objects traveling along different paths in space,**

**then by definition ... you have 2 objects not 1.**

**How do you propose to prove that they are one object?**

**THEIR DEFENSE OF ARTICLE**

We have single particles which travel along different paths. This is called self-interference or single-particle interference. Even if the beam intensity is so low, that at any time there is maximum one particle in the apparatus, an interference pattern builds up. We can strictly rule out the case that there are two neutrons, one going left, one going right, and that these two neutrons interfere. It is every single neutron which interferes with itself.

**MY REPLY TO THEIR DEFENSE**

**Then the total mass of the particle in the apparatus is**

**1.67493 × 10−27 (one neutron).**

**ORIGINAL ARTICLE**

*It is even possible to determine the ratio in which*

*the neutron was distributed between the two paths.*

**MY REPLY TO ARTICLE**

**Okay, let’s take 1 neutron (atomic mass: 1.67493 × 10−27)**

**and distribute its mass between the 2 paths**

**(since you claim the 1 neutron is traveling both paths simultaneously).**

**Each path will contain some fraction of the mass of a neutron.**

**Therefore, neither particle can be a neutron.**

**So what particles are traveling down the paths?**

**THEIR DEFENSE OF ARTICLE**

That's an interesting point. Properties like the mass or the magnetic moment of the neutron are well defined. When you measure these quantities you can measure them only as a whole, similar to the fact that you can only detect whole particles.

**MY REPLY TO THEIR DEFENSE**

**And therein lies your problem.**

**You cannot detect partial particles**

**like the ones that you are claiming**

**are speeding down 2 different paths.**

**THEIR DEFENSE OF ARTICLE**

But our experiment shows that the interaction strength can be fractional.

**MY REPLY TO THEIR DEFENSE**

**But you are claiming that a particle itself can be fractional**

**and travel down 2 separate paths. That is not the same thing.**

**THEIR DEFENSE OF ARTICLE**

Normally, if you apply a certain magnetic field for a certain time to the neutron spin, you rotate the spin by a certain angle. In our case this angle was smaller, because a certain fraction of the neutron was in the other path,

**MY REPLY TO THEIR DEFENSE**

**Thank you for verifying that my previous statement**

**was an accurate representation of your claim.**

**THEIR DEFENSE OF ARTICLE**

where no magnetic field was applied.

This is the evidence for the fractional presence of the neutron in the two paths.

**MY REPLY TO THEIR DEFENSE**

**Forgive me - I must have missed the evidence.**

**If the spin was rotated by a certain angle and the angle became smaller,**

**how do you get from there, to that being evidence for**

**the fractional presence of the neutron in the 2 paths?**

**Why couldn’t the decrease in angle represent something logical**

**instead of something nonsensical?**

**Or why not just say it is unexplainable at this point in time?**

**ORIGINAL ARTICLE**

*The double-slit experiment*

*"In the classical double-slit experiment, an interference pattern is created behind the double slit," explains Stephan Sponar from the Atomic Institute at TU Wien. "The particles move as a wave through both openings at the same time,*

**MY REPLY TO ARTICLE**

**Yet the detectors NEVER detect a wave moving through both slits.**

**They ALWAYS detect a particle moving through one, and only one slit.**

**THEIR DEFENSE OF ARTICLE**

As I said, particles can only be detected as a whole. But we didn't place detectors directly into the slits. We let the particles interfere and detected them (as whole particles) in the output ports of the interferometer. By measuring the spin direction we could in retrospect determine, to which amount they took the left or right path.

**MY REPLY TO THEIR DEFENSE**

**The total mass must be conserved,**

**so each partial particle would have a fraction of a neutron’s mass,**

**and therefore ... could not be a neutron.**

**Whichever amounts that you are claiming took each path,**

**neither path would have contained a neutron.**

**So what kind of particle are you claiming is in each path?**

**ORIGINAL ARTICLE**

*Reversing the rotation*

*The situation is different if, after the two neutron partial waves have merged, another magnetic field is used to turn the spin back again. By trial and error, one determines the angle of rotation that is necessary to turn the spin of the superimposed state back into the original direction. The strength of this rotation is a measure of how strongly the neutron was present in each path.*

*If it had taken only the path on which the spin has been rotated, the full angle of rotation would be necessary to rotate it back. If it had taken only the other path, no reverse rotation would be necessary at all. In the experiment carried out using a special asymmetric beam splitter, it was shown that the neutrons were present to one third in one path and to two thirds in the other.*

*Through detailed calculations, the team was able to show: Here, one does not merely detect an average value over the totality of all measured neutrons, but the statement applies to each individual neutron. It takes many neutrons to determine the optimal angle of rotation, but as soon as this is set, the path presence determined from it applies to every single neutron detected.*

*"Our measurement results support classical quantum theory," says Stephan Sponar. "The novelty is that one does not have to resort to unsatisfactory statistical arguments: When measuring a single particle,*

*our experiment shows that it must have taken two paths at the same time*

**MY REPLY TO ARTICLE**

**All neutrons have 1 up quark and 2 down quarks.**

**How do the 3 quarks in your neutron divide into each of your 2 paths?**

**THEIR DEFENSE OF ARTICLE**

You misunderstood. It is not true that e.g. one quark goes left and two quarks go right.

**MY REPLY TO THEIR DEFENSE**

**I was only asking – not asserting.**

**THEIR DEFENSE OF ARTICLE**

It's the whole neutron which takes both paths.

**MY REPLY TO THEIR DEFENSE**

**Now you have to explain how your apparatus**

**suddenly doubled the amount of mass contained within it.**

**If you have a whole neutron in each path then you have**

**2 x 1.67493 × 10−27 kg.**

**Explaining that without resorting to magic will be an impressive feat.**

**THEIR DEFENSE OF ARTICLE**

You can do interference experiments also with

particles which have no internal structure, e.g. electrons, and it still works.

The internal structure doesn't play any role here.

**MY REPLY TO THEIR DEFENSE**

**It’s true that internal structure would not play any role**

**in elementary particles like electrons and photons**

**because they have no internal structure.**

**But that isn’t the issue here.**

**Your experiment and your paper are based on neutrons ...**

**which do have internal structure.**

**MY REPLY TO ARTICLE**

**You also need to explain this ...**

[**https://en.wikipedia.org/wiki/Quark**](https://en.wikipedia.org/wiki/Quark)

**“*quarks are never found in isolation; they can be found only within hadrons* ”**

**So how can a hadronic particle (like a neutron)**

**made of quarks (which are only found in hadrons) ...**

**divide and allow the quarks to leave their hadron?**

**You also need to explain how you produced the enormous energy necessary**

**to separate the quarks from the strong nuclear force.**

**Where did the energy come from?**

**THEIR DEFENSE OF ARTICLE**

You just said it. There is no such energy and therefore the quarks are not separated.

**MY REPLY TO THEIR DEFENSE**

**Then you can only have 1 neutron.**

**THEIR DEFENSE OF ARTICLE**

The neutron as a whole (the triple of quarks) takes both paths at the same time.

**MY REPLY TO THEIR DEFENSE**

**Then you would have to have 6 quarks**

**in order to have 2 neutrons on the 2 paths.**

**Because, if you only have 3 quarks, like you just said,**

**then you only have 1 neutron.**

**ORIGINAL ARTICLE**

*and quantifies the respective proportions unambiguously." This rules out alternative interpretations of quantum mechanics that attempt to explain the double-slit experiment with localised particles.*

**MY REPLY TO ARTICLE**

**Based on the fact that you have presented no evidence**

**to support your assertions,**

**the only interpretation that seems to be ruled out ...**

**is yours.**

**THEIR DEFENSE OF ARTICLE**

As a concluding remark, let me just say, welcome to quantum mechanics. Nobody said that quantum mechanics can be understood with common sense. We have experimental evidence, gathered over 100 years, showing that the predictions of quantum mechanics are exactly correct. As concerns the interpretations, frankly speaking,

all attempts to explain it by our everyday classical way of thinking, failed.

**MY REPLY TO THEIR DEFENSE**

**It's hard to believe that a physicist like you could make a claim like that.**

**Surely, to get to the position you hold today,**

**you must have learned of the pilot-wave theory.**

**No voodoo is required in that theory.**

**THEIR DEFENSE OF ARTICLE**

You are better off to just accept concepts like superposition or non-locality.

**MY REPLY TO THEIR DEFENSE**

**I believe I’m better off by never accepting concepts**

**unless there is a scientific consensus backing them up**

**or at least solid evidence supporting their claims.**

**But thanks for the advice and good luck with your research.**

**VALEDICTION**

Cheers, from Hartmut

**MY FINAL WORDS:**

**I do not plan on sending the second email (my reply to their defense).**

**I don’t see the point in continuing to bump heads**

**over things that cannot be proven one way or the other.**

**Here is an excellent video that explains quantum mechanics**

**without any voodoo or magical thinking:**

**Pilot-Wave Theory (~16 minutes)**

<https://www.youtube.com/watch?v=RlXdsyctD50>