**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)

(*their claims in italics* ... followed by ... **my replies in bold**)

*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.*

**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)*.”**

*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.*

**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?**

*It is even possible to determine the ratio in which the neutron was distributed between the two paths.*

**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?**

*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,*

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

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

*and the two partial waves then interfere with each other. In some places they reinforce each other, in other places they cancel each other out." The probability of measuring the particle behind the double slit at a very specific location depends on this interference pattern: where the quantum wave is amplified, the probability of measuring the particle is high. Where the quantum wave is cancelled out, the probability is low. Of course, this wave distribution cannot be seen by looking at a single particle. Only when the experiment is repeated many times does the wave pattern become increasingly recognisable point by point and particle by particle.*

*"So, the behaviour of individual particles is explained based on results that only become visible through the statistical investigation of many particles," says Holger Hofmann from Hiroshima University, who developed the theory behind the experiment. "Of course, this is not entirely satisfactory.*

**To call that an understatement would be ... an understatement.**

*Rotating the neutron*

**No questions.**

*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*

**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?**

**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?**

*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.*

**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.**

**from neo**

**(replies are encouraged)**