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The shape of a photon

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INTRODUCTION

Research Objectives

The purpose of this research is to use quantum operators, known as 'Dimensional Gate Operator' (DGO) as a means of investigating the properties of quantum wave functions; in this case the shape of the wave function of light.

Background

Dimensional Gate Operators are based on the inverse of the multiplicative rules of arithmetic and therefore on the imaginary number 'i'. Under ordinary circumstances -1 by -1 equals +1. However, with imaginary numbers it is shown that +1 by +1 equals -1. This inverse operator is called XNOR.

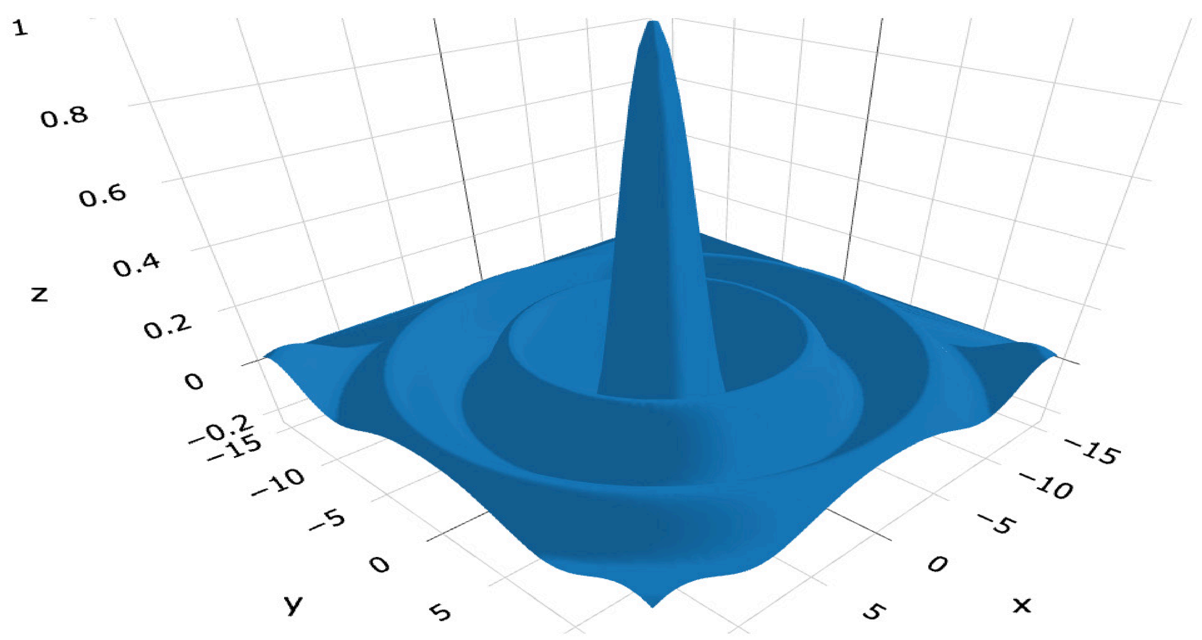


Figure 1: The so-called Mexican Hat figure is a good approximation of the dispersing wave packet of a photon.

METHOD

Photons and other quantum particles are usually modelled as planar waves via the Schrodinger Equation. In this instance, the researcher is using a Mexican Hat graph which is a good approximation of a quantum wave packet. The diagram in Figure 1 is an example of such a wave packet. By altering the terms of the operators from XOR to XNOR, this image can be rendered from the perspective of the DGO operator. This produces the diagram seen in Figure 2. The results of this toy model are unexpected. They reveal an intereference pattern, which could be used as an explanation for the Double Slit Experiment.

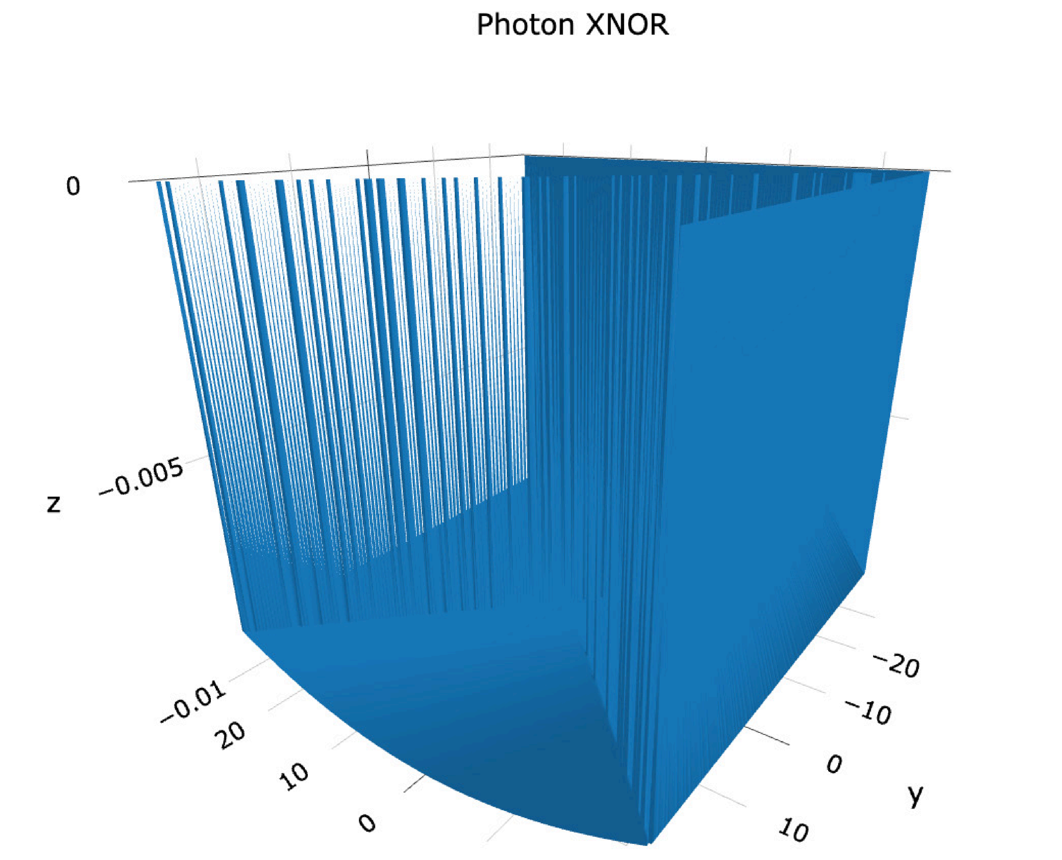


Figure 2: The XNOR version of the Mexican Hat Diagram in Figure 1. Notice that it contains interference like bands, which may have application in the expalnation of key factos of the 'Double-slit Exp.'

The wave equations in Figure 1 and Figure 2 are more like toy models. To produce a more complex and accurate result, an equation with an exponential decay coupling is used (See Below). This produces a more discrete wave packet utilised in the models of Quantum Field Theory.

$$z = (2exp(-1.2\sqrt{x^2+y^2})cos(7\sqrt{x^2+y^2})cos(x))$$

When the XNOR version of this wave form is taken it produces Figure 3. But before this it creates certain error values, which are replaced by '1'. This produces the x-shape in the data. A full quarter of the data is also absent or eleminated.

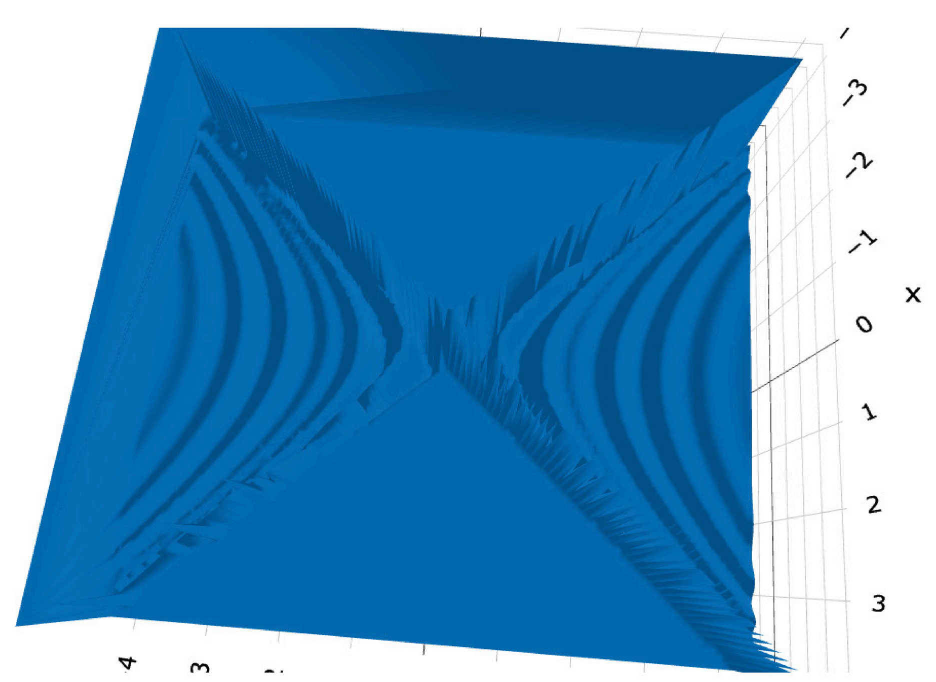
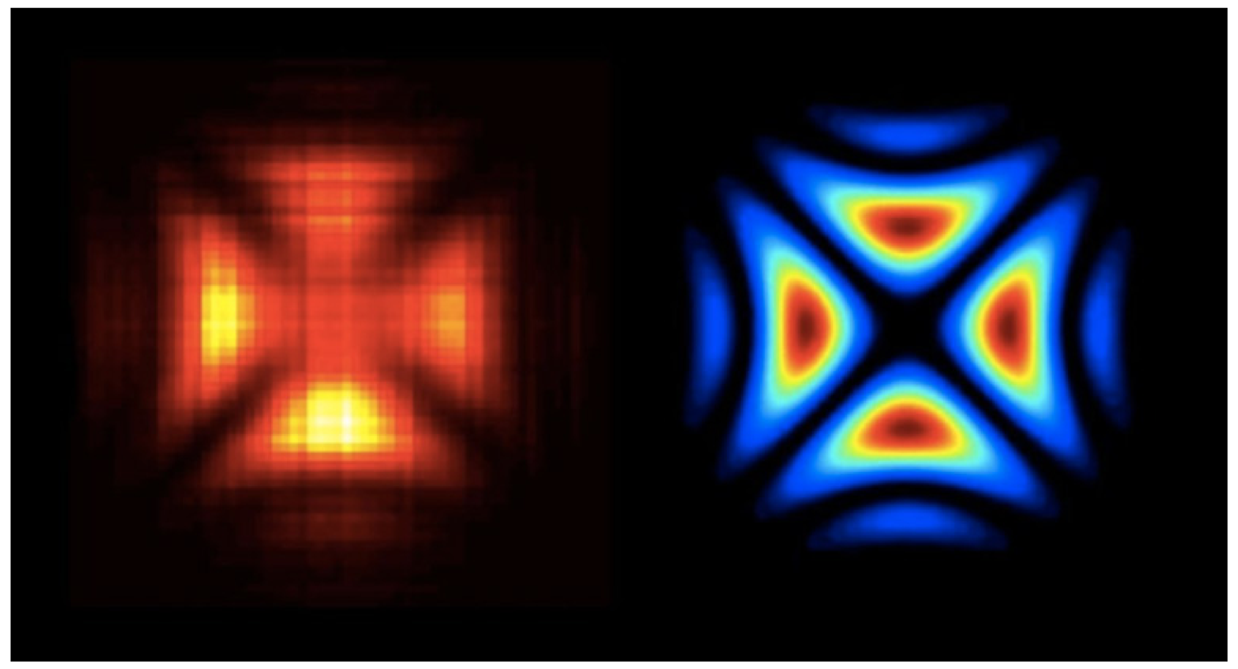


Figure 3: The XNOR version of the Exponential Decay Photon Wave packet results in a distorted frigne in the data.

RESULTS

The results of the XNOR wave function in Figure 3 looks very similar to the theoretical predictions based on the Schrödinger equation (Fig. 4(b)), as well as experimental imaging evidence carried out by physicists at the University of Warsaw (Fig. 12(a)). (Available at: https://cosmosmagazine.com/physics/what-shape-is-a-photon/ Last visited: 2012/08/13).



(a) (b)
Figure 4: The theoretical predictions based on the Schrödinger equation (b), and the experimental imaging carried out by physicists at the University of Warsaw (a)

This is a very promising result. However, there are certain problems with it. To begin with, there is the missing data in Figure 3 to contend with. To solve this the waveform can be rotated by 90 degrees and summed with itself. This produces the result in Figure 5, which is closer to the University of Warsaw result.

To create a full XNOR photonic waveform, it likely would be necessary to graph a spherical wave front and then transform that into XNOR. Another problem with this research is that the University of Warsaw results do not actually appear to be the image of a photon, but rather the interference pattern of at least two photons.

More troubling still, it is difficult to confirm this methodology and result, as the paper is nowhere to be found at the journal is was supposedly published in.

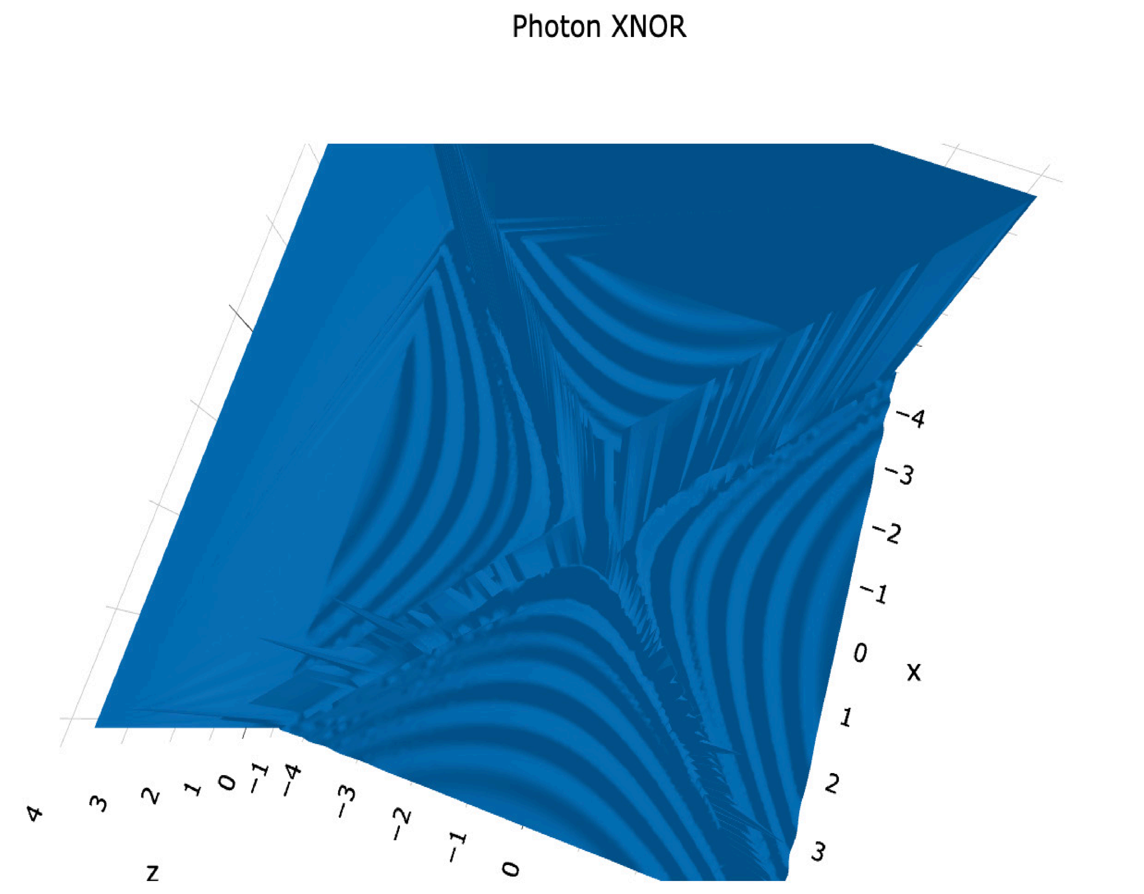


Figure 5: The XNOR photon graph rotated by 90 degrees and superimposed.

CONCLUSION

There is good agreement between the Dimensional Gate Operator method and that of experiment. However, the lack of any evidence of the University of Warsaw paper online suggests that the research may have been redacted. Assuming that is not the case, the results show a direct relationship between the mathematics of XNOR space and particle physics. The method therefore provides good insight into these quantum systems.

References

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