

Psychophysical interactions with a single-photon double-slit optical system

Abstract:

Background

The quantum measurement problem refers to the well-established but still mysterious fact that quantum objects behave differently when observed than when not observed.

Aim

To help empirically inform this problem, we conducted an experiment to see if mental attention directed toward a single-photon double-slit system would cause a change in the interference pattern.

Method

Photons arriving at an interference pattern minimum were counted per second while participants were asked to direct their attention toward or away from the double-slit. If consciousness "collapsed" the quantum wavefunction through the passively act of mental observation, then during attention-toward periods we predicted that photon counts at the minimum would increase.

Results

After a pilot study and six formal experiments, the results showed a modest (2 sigma) decrease in photon counts, opposite to our prediction. However, some of the experiments resulted in a strong count decrease and others in a strong increase. The combined variance across experiments was associated with a 4.5 sigma increase, indicating an unstable, anomalous effect.

Conclusion

These studies did not provide evidence for a passive collapse of the quantum wavefunction, but rather a more active effect possibly modulated by the context of the observation, created by the feedback used to mentally "connect" the participants to the optical system. This steering effect seems reminiscent of a quantum Zeno or anti-Zeno phenomenon.

Keywords

Quantum measurement problem, double-slit, consciousness

Published Work:

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