Can Alice influence Bob?
A new EPR experiment without correlation measurements.

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January 27, 2023

Abstract: The question *is reality governed by non-causal probabilistic quantum mechanics, or by a strict classical causal relationship,* seems to be settled and supports the Copenhagen interpretation of QM; every Bell-type experiment reports to refute the strict causal relationship with hidden variables as explanation. Here I propose an EPR experiment where Alice does no observation, but uses a 75:25 biased polariser. This new experiment would decide if spooky action at a distance is attributed to a *collapse of a wavefunction* or a manifestation from an unknown classical *conservation phenomenon* as a universal hidden variable. If it is the later quantum mechanics should then be interpreted as probabilistic but causal.

This article is written with the assumption that the reader is conversant with the Copenhagen interpretation of quantum mechanics, the challenge to it by Einstein, Podolsky and Rosen (EPR) ubiquitously known as the EPR paradox [1], and Bell's refutal [2] and Clauser's [3] proposed experiment. The results of all Einstein, Podolsky and Rosen vs Bell (EPRB) experiments are reported to support the Copenhagen interpretation and refute the EPR challenge, the first of these by Freedman and Clauser[4, 5]. The unexplored question that remains is: Are the EPRB experiment results explained by a *collapse of a wavefunction* or does reality include entanglement as an unknown *conservation phenomenon.* Here I propose an EPR experiment where Bob can decide if spooky action at a distance is the result of a *collapse of a wavefunction* or an unknown classical *conservation phenomenon* which could open doors to *new physics.* In essence, both *wavefunction collapse* and *universal conservation* give the same result, however the latter does not requiring observation and is causal.

The experimental setup is that a source sends simultaneously two entangled photons to Alice and Bob. Alice receives her photon before Bob does his. She passes the photon through a biased 75:25 vertical-horisontal polariser but does not observe the photon, that is she lets it travel unhindered into space.

Alice's polariser is constructed as follows: The incoming beam of photons are split into an ordinary or an extraordinary polarised beam. The extraordinary

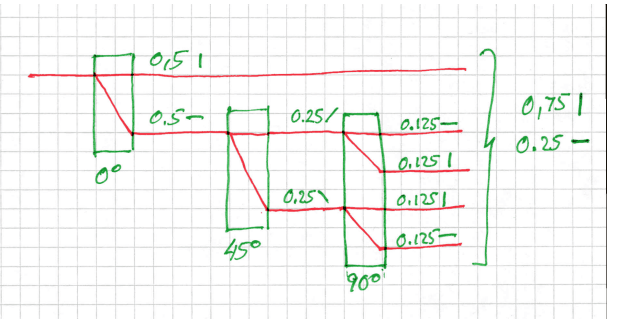

Figure 1: Schematic of Alice's 75:25 polariser

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polarised beam passes through a secondary stack of two further polarises each rotated by 45° relative to the previous. Half the photons making up the extraordinary beam are now rotated into the ordinary orientation resulting in a final 75:25 distribution. (See Fig 1)

Now what does Bob measure? There are two possible outcomes.

1. Because Alice does not observe the photons passing through her 75:25 polariser, then according to QM they remain in a state of superposition of several eigenstates. Consequently, QM predicts for Bob a 50:50 vertical-horisontal distribution.

2. Alternatively, Bob measurements would be skewed towards a 25:75 vertical-horisontal distribution. This is explained classically as follows: The photon–polariser interaction at Alice's station needs to remain universally nilpotent. That polarisers are inactive is argued by the extension of the Mössbauer effect [6]. Noether's theorem demands a *conservation phenomenon* that acts on the paired and entangled photon instantaneously. Preservation of a universal state cannot be governed by the chance encounter of an observation by Alice.

I predict the latter and if proven by experiment would finally give the answer to Einstein, Podolsky and Rosen question as: The quantum-mechanical description of the physical reality is not complete, which also raises the question: Are the fundamental assumptions that underpin the 20^{th} century physics theories correct?

Furthermore, this experiment—if successful—provides a gateway to superlumenal, and detection free, communication by simply interrupting (observing) the photon beam before the 75:25 polariser.

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Biblatex for citing this article:

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@Article{Vrba-2023-1751,
   author    = {Vrba, Anton Lorenz},
   title     = {Can Alice influence Bob? A new EPR experiment
                without correlation measurements.},
   year      = {2023},
   pages     = {Online},
   journal   = {Proceedings: Harbingers of Neophysics},
   publisher = {PhysNew Ltd},
   address   = {Ryde, UK},
   issn      = {2753-5770},
   url       = {https://neophysics.org/p/1751},
   urldate   = {2023-01-27},
}
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