Non-Classical Issues In Quantum Mechanics

Superposition

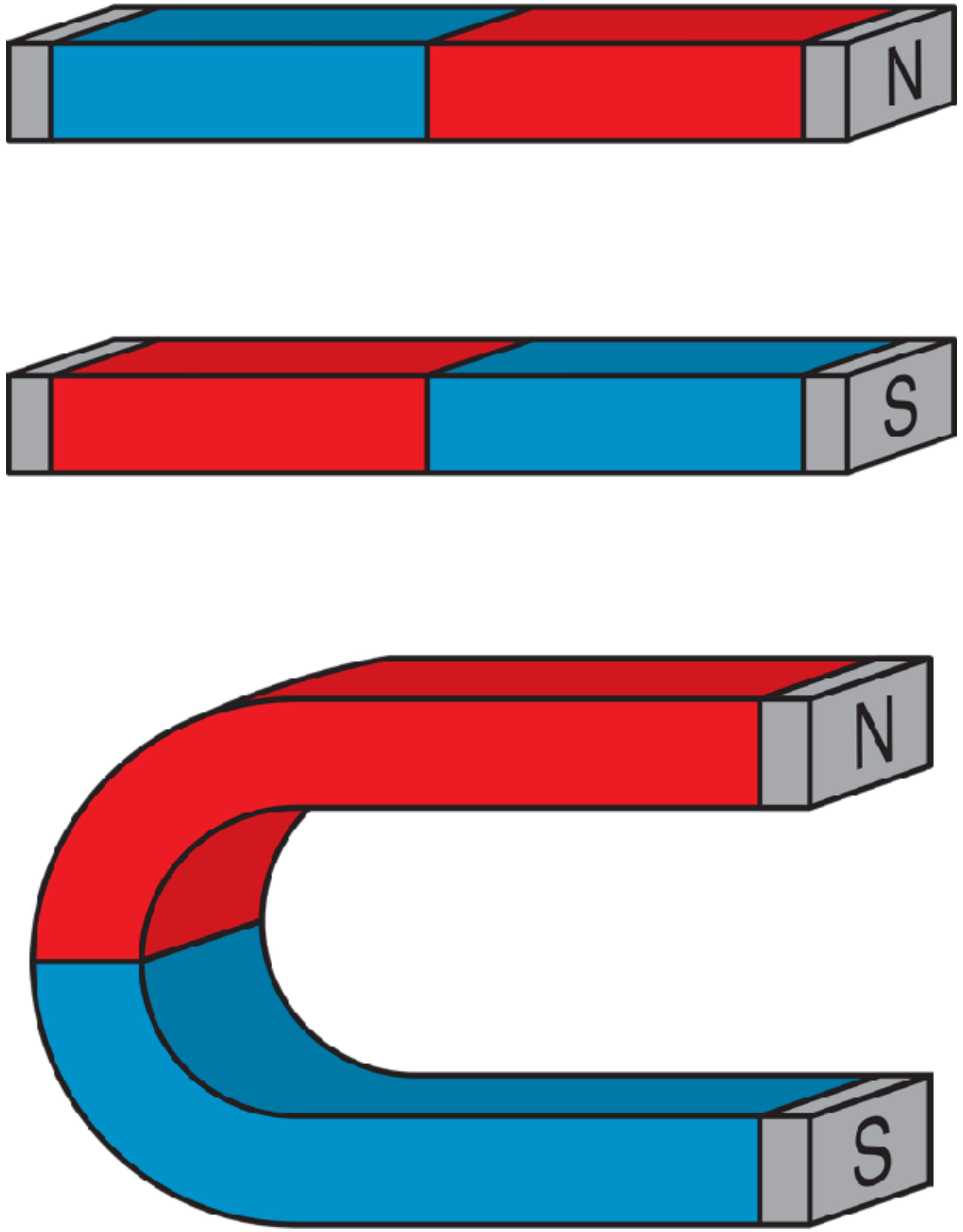
Collapse of the wave function

Probabilities

What constitutes a measurement

Wave-particle duality

Non-locality (Action at a Distance)



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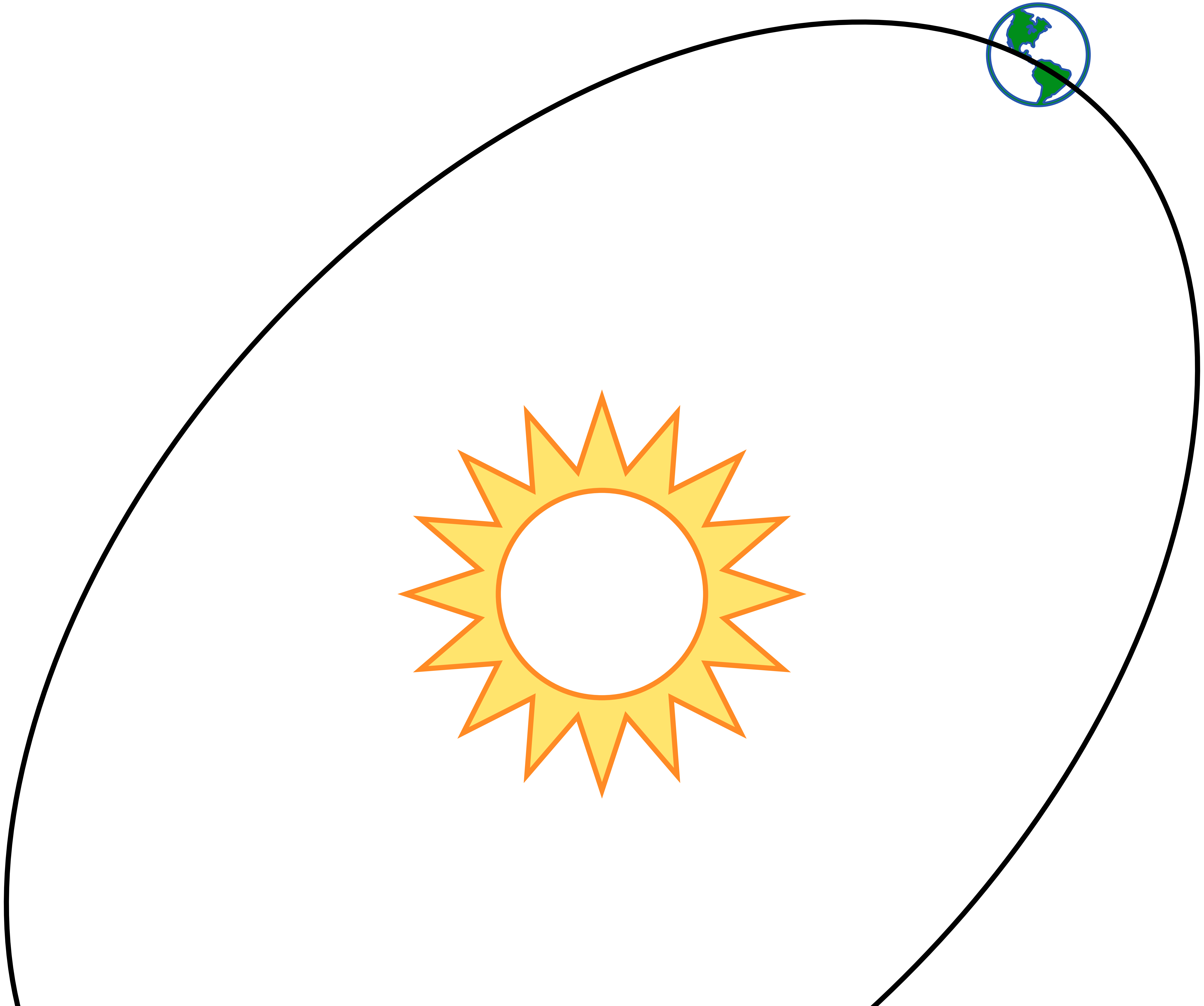


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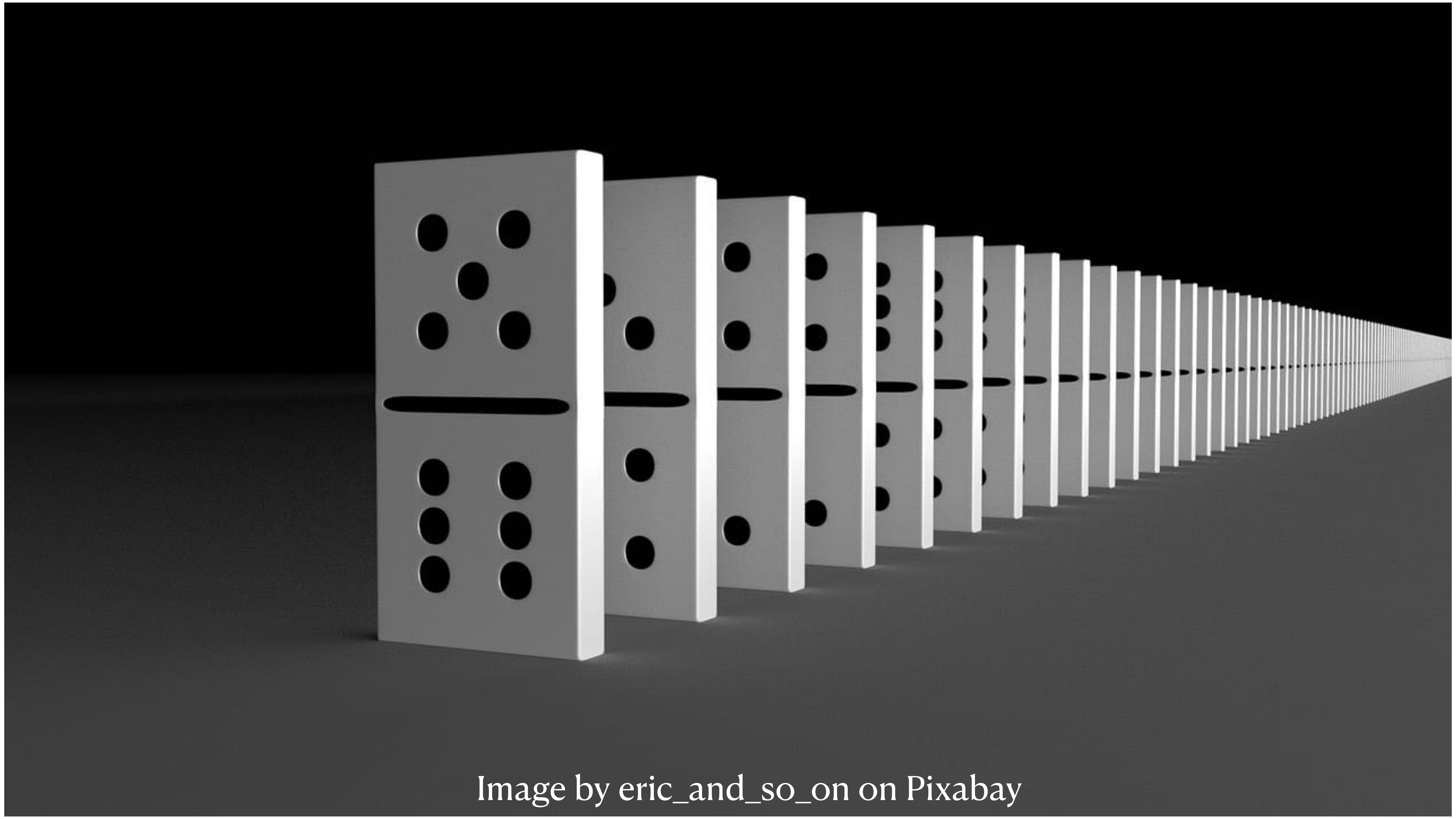

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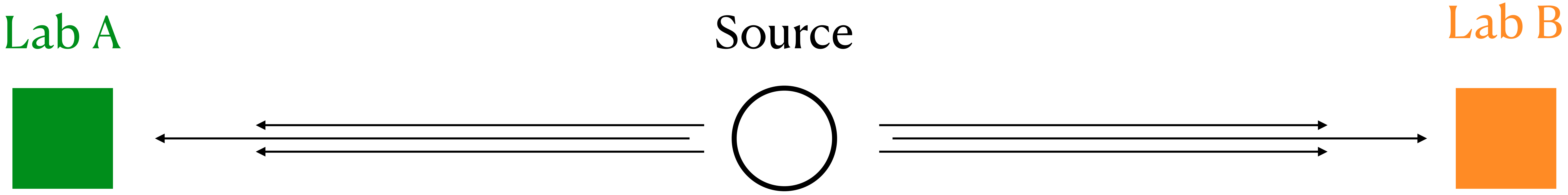
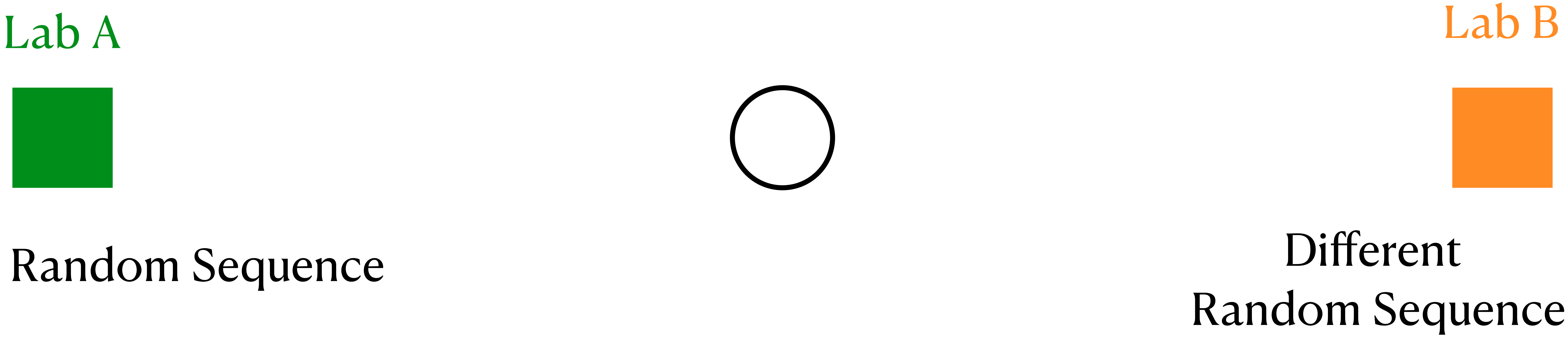


Lab A
Source
Lab B


Lab A
Random Sequence
Lab B
Different
Random Sequence

for trapping as b decreases is reflective of the incorporation of periodic components into the sequence of numbers generated.

To summarize the motivation and principal conclusion of this Letter, we restate[1] that for values of b where numerically generated sequences *appear* to be chaotic, it has not been settled whether those sequences "are truly chaotic, or whether, in fact, they are really periodic, but with exceedingly large periods and very long transients required to settle down." On the one hand, Grossman and Thomae[5,6] have suggested that (only) the parameter value $b=1$ generates pure chaos [see the discussion following Eq. (31) of Ref. 5 and the correlations plotted in their Fig. 9]. On the other hand, for certain *other* values of b, numberical results of Lorenz (reported in Ref. 1) "strongly suggest that the sequences are truly chaotic." The purpose of this communication was to use an independent and exact result from the statistical-mechanical theory of $d=1$ random walks to test the randomness of the parabolic map for parameter values where the existence of "true chaos" is still an open question. Our results strongly support the conclusions of Grossmann and Thomae.

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Experimental Test of Bell's Inequalities Using Time-Varying Analyzers

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Correlations of linear polarizations of pairs of photons have been measured with time-varying analyzers. The analyzer in each leg of the apparatus is an acousto-optical switch followed by two linear polarizers. The switches operate at incommensurate frequencies near 50 MHz. Each analyzer amounts to a polarizer which jumps between two orientations in a time short compared with the photon transit time. The results are in good agreement with quantum mechanical predictions but violate Bell's inequalities by 5 standard deviations.

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Bell's inequalities apply to any correlated measurement on two correlated systems. For instance, in the optical version of the Einstein-Podolsky-Rosen-Bohm *Gedankenexperiment*,[1] a source emits pairs of photons (Fig. 1). Measurements of the correlations of linear polarizations are performed on two photons belonging to the same pair. For pairs emitted in suitable states, the correlations are strong. To account for these correlations, Bell[2] considered theories which invoke common properties of both members of the

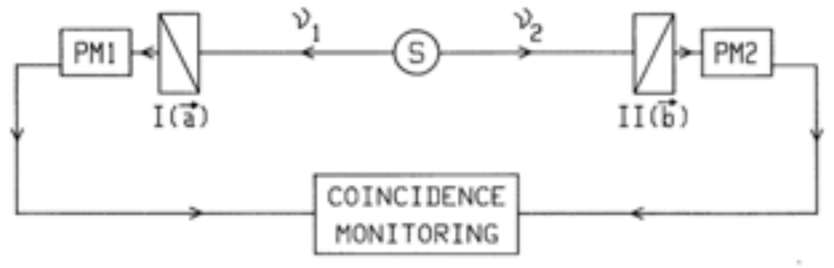

FIG. 1. Optical version of the Einstein-Podolsky-Rosen-Bohm *Gedankenexperiment*. The pair of photons ν_1 and ν_2 is analyzed by linear polarizers I and II (in orientations $\vec{a}$ and $\vec{b}$) and photomultipliers. The coincidence rate is monitored.

The key experiments were done in 1982, and the researchers won the Nobel Prize in 2022. There have been a lot of "explanations" written, and to be honest, there is a certain amount of gobbledegoop out there, because people like to have a <u>concrete</u> answer, even if it's nonsense. We still don't know how the photons communicate with each other, and we still don't know how WE can communicate with each other faster than light.

This video is about the motivation for Bell's theorem and the photon correlation experiments. The next video is about the analysis of the experimental results. When I first read about the 1982 experiments by Alain Aspect and colleagues, I found it hard to follow the logic of Bell's Inequality. I created a story of a time machine to help me understand it, and that's what I will share.

Entangled electrons:

Entangled photons: