

(*This part cannot be modified.*)

$$\text{AC} := \left\{ \left\{ N_0 = \sum_{j=1}^n \text{If}[\alpha[j] == \beta[j], 1, 0], N_{E0} = \sum_{j=1}^n \text{If}[\text{And}[\alpha[j] == \beta[j], A[j] == B[j]], 1, 0] \right\}; \right.$$

 If[$N_{E0} > 0$, $N[100 - 100 * N_{E0} / N_0]$ "% Anti-correlation only. Model fails to describe anti-correlation when Alice and Bob happen to measure with the same angle.", "Anti-correlation at equal angles OK."];

$$\text{BellT} := \left\{ \left\{ N_{U1} = \sum_{j=1}^n \text{If}[\text{And}[\beta[j] - \alpha[j] == -\frac{\pi}{8}, A[j] \neq B[j]], 1, 0], \right. \right.$$

$$N_{E2} = \sum_{j=1}^n \text{If}[\text{And}[\beta[j] == \frac{\pi}{4}, A[j] == B[j]], 1, 0], N_{U3} = \sum_{j=1}^n \text{If}[\text{And}[\beta[j] - \alpha[j] == -\frac{3\pi}{8}, A[j] \neq B[j]], 1, 0] \left. \right\},$$

"The Bell inequality predicts that the first number is smaller than the sum of the second and third numbers. It holds in all directly real models (local realism).

On principle, all directly real models can be realized by modifying this computer realization.",

If[$N_{U3} + N_{E2} < N_{U1}$, "Bell's inequality is violated! Please play again.

QM violates Bell's inequality roughly 99 times of 100 (assuming 800 photon pairs per trial).",

"QM violates the Bell inequality 99 times out of 100

runs (assuming 800 photon pairs per run), which excludes directly real models."];

$$\text{CHSH} := \left\{ \left\{ N_3 = \sum_{j=1}^n \text{If}[\beta[j] - \alpha[j] == -\frac{3\pi}{8}, 1, 0], N_{E3} = \sum_{j=1}^n \text{If}[\text{And}[\beta[j] - \alpha[j] == -\frac{3\pi}{8}, A[j] == B[j]], 1, 0], \right. \right.$$

$$N_1 = \sum_{j=1}^n \text{If}[\beta[j] - \alpha[j] == -\frac{3\pi}{8}, 1, 0], N_{E1} = \sum_{j=1}^n \text{If}[\text{And}[\beta[j] - \alpha[j] == -\frac{3\pi}{8}, A[j] == B[j]], 1, 0], N_2 = \sum_{j=1}^n \text{If}[\beta[j] - \alpha[j] == \frac{\pi}{4}, 1, 0],$$

$$E_0 = \frac{2 N_{E0}}{N_0} - 1, E_1 = \frac{2 N_{E1}}{N_1} - 1, E_2 = \frac{2 N_{E2}}{N_2} - 1, E_3 = \frac{2 N_{E3}}{N_3} - 1 \left. \right\};$$

CHV = $N[\text{Max}[\text{Abs}[E_0 + E_1 + E_2 - E_3], \text{Abs}[E_0 + E_1 - E_2 + E_3], \text{Abs}[E_0 - E_1 + E_2 + E_3], \text{Abs}[E_1 + E_2 + E_3 - E_0]]]$,

If[CHV > 2, "CHSH inequality is violated!", "CHSH inequality is not violated."];

n = 800; Table[H[j] = 2 π Random[], {j, n}];

Table[$\alpha[j]$ = If[Random[] < 0.5, 0, 3] ($\pi / 8$), {j, n}];

Table[A[j] = If[Random[] < (Cos[$\alpha[j]$ - H[j]])^2, 1, 0], {j, n}];

Table[$\beta[j]$ = If[Random[] < 0.5, 0, 2] ($\pi / 8$), {j, n}];

Table[B[j] = If[Random[] < (Cos[$\beta[j]$ - (H[j] + $\pi / 2$))]^2, 1, 0], {j, n}];

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AC
MatrixForm[BellT]
CHSH
Clear[A, B,  $\alpha$ ,  $\beta$ ]

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Out[249]= {76.6798 % Anti-correlation only. Model fails to
           describe anti-correlation when Alice and Bob happen to measure with the same angle.}

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Out[250]//MatrixForm=

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{183, 195, 69}

The Bell inequality predicts that the first number is smaller than the sum of the second and third numbers.
It holds in all directly real models (local realism).
On principle, all directly real models can be realized by modifying this computer realization.
QM violates the Bell inequality 99 times out of 100 runs (assuming 800 photon pairs per run), which excludes directly re

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Out[251]= {2.00543, CHSH inequality is violated!}

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In[253]:=

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In[254]:=

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In[255]:=

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