

Documentation on

Dataset for Manuscript “Topological Hong-Ou-Mandel interference “

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1. General information

Title of record: Dataset for Manuscript „Topological Hong-Ou-Mandel interference “

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2. Description

This documents provides a guideline for the data repository of publication [1]. The guideline reports on the archive structure as well as the acquisition and processing of the measurement data.

3. File format

The data are provided in “TXT”-format files, using the DOT-delimiter (.) as decimal delimiter and the TAB-delimiter to separate the array elements.

4. Archive Structure and Data Acquisition

Dataset for Hong-Ou-Mandel experiments

The data are contained in the datasets “FIG_3B.txt“, “FIG_3E.txt“ and “FIG_3F.txt“ are recorded coincidence rates of photon pairs as a function of the photons’ time delay. The coincidences are recorded with a time-correlation card (Becker & Hickl) which processes the signals of two single-photon counting modules. The datasets are structured as follows:

time delay τ (ps)	coincidence rates C (Hz)
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The acquisition time for coincidence rates is $T = 10$ s.

Dataset for demonstration of propagation-invariant two-photon suppression

The data are contained in the file „ Figure_3C.txt“ are two-photon coincidence rates (and statistical errors) of photon pairs detected at the output of birefringent directional couplers of different propagation distances. The coincidence rates are recorded using indistinguishable (same arrival time at the birefringent directional coupler) and distinguishable (arrive with a 1 ps time delay at the birefringent directional coupler) photon pairs with acquisition times $T = 1000$ s and $T = 2000$ s, respectively. The dataset is structured as follows:

	indistinguishable Photons ($T = 1000$ s)		distinguishable photons ($T = 2000$ s)	
Propagation distance z (mm)	coincidence rates C_{ind} (Hz)	error of coincidence rates $C_{\text{ind}}^{\text{err}}$ (Hz)	coincidence rates C_{dis} (Hz)	error of coincidence rates $C_{\text{dis}}^{\text{err}}$ (Hz)

The data contained in the file „Figure_3D.txt“ are Hong-Ou-Mandel visibilities as function of the propagation distance in the birefringent directional coupler. The data are computed from the coincidence C_{ind} and C_{dis} rates of indistinguishable and distinguishable photons, respectively, as contained in the dataset for Fig. 3C. The dataset is structured as follows:

Propagation distance z (mm)	Visibilities $v = \frac{C_{\text{ind}}}{C_{\text{dis}}} - 1$	Visibility error: $v^{\text{err}} = v \left(\left \frac{C_{\text{ind}}^{\text{err}}}{C_{\text{ind}}} \right + \left \frac{C_{\text{dis}}^{\text{err}}}{C_{\text{dis}}} \right \right)$
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The data contained in “FIG_S1.txt” are the recorded components $S_{1,2,3}$ of classical laser light displaying the normalized Stokes vectors $\vec{S} = (1, S_1, S_2, S_3)^T$ detected with a polarimeter (Thorlabs PAX1000IR1/M) that is placed at the output of a birefringent waveguide. The Stokes components are listed as a function of propagation distance in the birefringent waveguide and are used to determine the birefringence in the waveguides used. The data are structured as follows:

Propagation distance z (mm)	S_1	S_2	S_3
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Dataset for the demonstration of error-resilience under input state perturbation

The data contained in file “FIG_4A_WG1.txt” and “FIG_4A_WG2.txt” are recorded components $S_{1,2,3}$ of the normalized Stokes $\vec{S} = (1, S_1, S_2, S_3)^T$ vectors at the input face of the chip that are detected with a polarimeter (Thorlabs PAX1000IR1/M) when probed with classical laser light. The data are structured as follows:

S_1	S_2	S_3
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The Stokes components in each row were recorded in time increments of 50 ms.

The data contained in file “FIG_4B_IND.txt”, “FIG_4B_DIS.txt” and “FIG_4B_VIS.txt” contain two-photon coincidence rates of indistinguishable (C_{ind} (Hz)) and distinguishable (C_{dis} (Hz)) photons and corresponding Hong-Ou-Mandel visibilities ($v = C_{\text{ind}}/C_{\text{dis}} - 1$), respectively. The coincidences were recorded at after the output of birefringent directional couplers of different lengths $z = 9$ mm, 15mm, 21 mm, 27 mm. The $S_1 = 1 - \Delta S$ component of the photons initial Stokes vector was perturbed by $\Delta S = 0, 0.02, 0.05, 0.1$. The data are structured as follows:

ΔS_1 (rows)/Length z (columns)	9 mm	15 mm	21 mm	27 mm
0.02				
0.05				
0.1				

Dataset for demonstration of error-resilience under coupling rate mismatch

The data contained in “FIG_SA2.txt” are the recorded S_1 -component of the normalized Stokes vectors $\vec{S} = (1, S_1, S_2, S_3)^T$ detected with a polarimeter (Thorlabs PAX1000IR1/M) placed at the output of a birefringent waveguide and are used to determine the birefringence in the waveguide to estimate the coupling mismatch. The Stokes component S_1 is listed as a function of propagation distance in the birefringent waveguide.

Propagation distance z (mm)	S_1
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The data are contained in the file „Figure_S2B.txt“ are two-photon coincidence rates (and statistical errors) of photon pairs detected at the output of birefringent directional couplers of different propagation distances. The coincidence rates are recorded using indistinguishable and distinguishable photon pairs as well as for background coincidences with acquisition time of $T = 1800$. The dataset is structured as follows:

	Indistinguishable Photons ($T = 1000$ s)		Distinguishable photons ($T = 2000$ s)	
Propagation distance z (mm)	Coincidence rates C_{ind} (Hz)	Error of coincidence rates $C_{\text{ind}}^{\text{err}}$ (Hz)	Coincidence rates C_{dis} (Hz)	Error of coincidence rates $C_{\text{dis}}^{\text{err}}$ (Hz)

Furthermore, due to the low coincidence rates, we record the background coincidence rates $C_B = (0.5774 \pm 0.0179)$ Hz when the two-photon source was turned off.

The data contained in the file „Figure_S2C.txt“ are Hong-Ou-Mandel visibilities as function of the propagation distance in the birefringent directional coupler. The data are computed from the coincidence C_{ind} and C_{dis} rates of indistinguishable and distinguishable photons, respectively, as contained in the previous dataset. The dataset is structured as follows:

Propagation distance z (mm)	Visibilities $v = \frac{c_{\text{ind}} - c_{\text{B}}}{c_{\text{dis}} - c_{\text{B}}} - 1$	Visibility error: $v^{\text{err}} = v \left(\left \frac{c_{\text{ind}}^{\text{err}}}{c_{\text{ind}}} \right + \left \frac{c_{\text{dis}}^{\text{err}}}{c_{\text{dis}}} \right \right)$
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The data contained in file "FIG_4C.txt" show the average of visibilities and average visibility errors of the two previous datasets as well as the corresponding relative coupling mismatch of birefringent directional couplers. The data are structured as follows:

Coupling mismatch	Coupling mismatch error	Average visibility	Average visibility error
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5. References

[1] M. Ehrhardt, C. Dittel, M. Heinrich and A. Szameit, Topological Hong-Ou-Mandel interference, *Science* (2024). DOI: 10.1126/science.ado8192