I. CALCULATION OF SPECTRAL FITTING PARAMETERS

As mentioned in the main text, the 10-peak model was the most probable fit for the bulk Cu_2O data. The best-fit parameters from the model are given in Tables I and II. Table I gives the peak-independent parameters, including the bandgap energy of the system (E_g), the Rydberg binding energy (Ry), the inhomogeneous broadening (σ), the Urbach absorption coefficient (a_0), and Urbach energy (E_u). Table II gives the peak-dependent parameters, namely the quantum defects (δ_n), spectral linewidths (Γ_n), Fano asymmetry factors (q_n), and peak heights (f_n), for each peak.

TABLE I. Peak-independent parameters from Bayesian reconstruction of bulk Cu_2O OD spectrum

E_g(eV)	R_y(meV)	σ (nm)	α_0 (unitless)	E_u (eV)
2.173	94.9	0.02	0.2864	0.008

TABLE II. Peak-dependent parameters from Bayesian reconstruction of bulk Cu_2O OD spectrum.

n	δ_n	Γ_n (nm)	q_n	f_n (a.u.)
2	0.0096	0.66	3.23	0.185
3	0.043	0.249	4.51	0.0956
4	0.0436	0.129	3.64	0.0458
5	0.0789	0.0992	5.469	0.0246
6	0.0942	0.0787	9.1153	0.0127
7	0.0919	0.0611	9.1415	0.006
8	0.0986	0.0414	9.359	0.003
9	0.0907	0.0217	7.4665	0.0014
10	0.0909	0.0103	7.2898	0.00076
11	0.09	0.0051	6.666	0.00014

Tables IV and III give the peak-dependent and peak-independent parameters from the 8-peak model found by Bayesian reconstruction as the best fit for the PL data from the synthetic sample.

TABLE III. Peak-independent parameters from Bayesian reconstruction of synthetic Cu_2O PL spectrum

E_g (eV)	R_y (meV)
2.174	93.4

TABLE IV. Peak-dependent parameters from Bayesian reconstruction of synthetic Cu_2O PL spectrum.

n	δ_n	Γ_n (nm)	f_n (a.u.)
2	0.0577	0.8598	0.3590
3	0.0807	0.3713	0.0761
4	0.1436	0.2374	0.0984
5	0.1079	0.1948	0.0248
6	0.2151	0.2729	0.0265
7	0.2047	0.2560	0.0225
8	0.1645	0.3102	0.0243