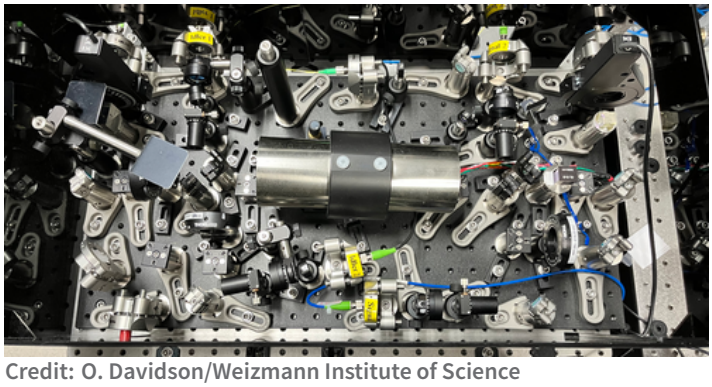
“Order Up”: A Pair of Photons

Researchers use two clouds of rubidium vapor to generate, store, and simultaneously release two photons.

By **Charles Day**

Researchers can readily coax a cloud of atoms to emit a single photon. But because the photon emission process is random, getting an atomic cloud to simultaneously generate two or more photons essentially requires waiting for a coincidence. An alternative approach involves storing one photon in a quantum memory and then releasing it after a second photon is generated. Now Omri Davidson of the Weizmann Institute of Science in Israel and his colleagues have improved that approach, achieving unprecedented efficiency [1].

At the heart of the Weizmann setup were two clouds of rubidium vapor each trapped inside a simple glass cell at room temperature. Two lasers illuminated one of the clouds, prompting its atoms to emit pairs of photons at two closely spaced wavelengths, 780 nm (termed the signal) and 776 nm (the idler). Signal photons followed paths that sent them either to the second cloud, which served as the quantum memory, or to the exit. Idler photons followed paths that triggered either the trapping of a signal photon in the quantum memory or its release. The release time of the stored photon was engineered such that the two photons exited the system simultaneously.



Credit: O. Davidson/Weizmann Institute of Science

The quantum memory stored the photons with an end-to-end efficiency of 25%, enabling the synchronization of more than 1000 photon pairs per second. The rate constitutes a 1000-fold improvement over other schemes based on atomic systems. Several promising quantum technologies rely on the simultaneous emission of two or more photons. Davidson says that the Weizmann group’s demonstration could bring those technologies closer to implementation.

Charles Day is a Senior Editor for *Physics Magazine*.

REFERENCES

1. O. Davidson *et al.*, “Single-photon synchronization with a room-temperature atomic quantum memory,” **Phys. Rev. Lett. 131, 033601 (2023).**