

**20.1. Experimental Entanglement Swapping: Entangling Photons That Never Interacted**, J.-W. Pan, D. Bouwmeester, H. Weinfurter, and A. Zeilinger, *Phys. Rev. Lett.* **80**, 3891 (1998) (J.Wolters)

**Presenter (10 min):**

Sketch the key idea and result (3 slides max).

Bibliometrics: What do you know about the authors?

Is the paper a milestone?

1. What is the key difference in entanglement swapping as compared to the previously reported methods to entangle two particles?
2. How can entanglement swapping be used in quantum communication/applications?
3. Take pen and paper and proof Eq. (3)!
4. Why is it necessary to project particles 2 and 3 to observe the entanglement of particles 1 and 4?
5. Why is only the projection  $|\Psi^-\rangle_{23}$  analysed? Would it be equally possible to analyze all other projections onto Bell states?
6. What does it mean to erase the Welcher-Weg information? How is this experimentally achieved?
7. Is it relevant which photon pair is measured first (i.e. 1 & 4, or 2 & 3)?
8. What is the principle of operation of the used EPR source(s)?
9. Why is the  $\lambda/2$  plate chosen to be at  $22.5^\circ$  for the measurement shown in Fig. 3?
10. What makes the measurement lengthy and annoying? Try to estimate the acquisition time for each data point in Fig. 3! Is your estimate consistent with the given 4000 s?
11. Can the experiment be interpreted as an “event-ready” generation of entanglement? Discuss the role of multi-photon generation events
12. Discuss the link of this experiment to quantum teleportation!