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Experimental controls of a superposition of coherent states MAKOTO TAKEUCHI, NICT, J.S. NEERGAARD-NIELSEN, HIROKI TAKA-HASHI, KENTARO WAKUI, MASAHIRO TAKEOKA, KAZUHIRO HAYASAKA, MASAHIDE SASAKI — We have generated Schrödinger cat states of coherent light by photon subtraction [K. Wakui et al., Opt. Express 15, 3568 (2007), H. Takahashi et al., Phys. Rev. Lett. 101, 233605 (2008)]. By using the cat states as ancillas, quantum computations in the coherent state basis can be realized [T. C. Ralph et al., Phys. Rev. A 68, 042319 (2003). Related to that idea, we have proposed a method to control the superposition coefficients of two phase-opposite coherent states [M. Takeoka and M. Sasaki, PRA 75, 064302(2007)]. It is based on a squeezer of coherent vacuum, a beam splitter, a displacement operation, and an on/off-type photon detector. The superposition coefficients can be controlled by properly setting the complex amplitude of the displacement. In this presentation, we report on the experimental demonstration of our proposal. To measure the superposition coefficients, we performed quantum state reconstruction with homodyne tomography. These experimental results agree well with our theoretical expectations. Quantum computation in the coherent state basis will work as the collective quantum decoder for coherent optical communications, which can attain the capacity of lossy bosonic channels [V. Giovannetti et al., Phys. Rev. Lett. 92, 027902(2004)].

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