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Rapid creation of distant entanglement by multi-photon resonant fluorescence[1] GUY Z. COHEN, L.J. SHAM, University of California, San Diego — We study a simple, effective and robust method for entangling two separate stationary quantum dot spin qubits with high fidelity using multi-photon Gaussian state. The fluorescence signals from the two dots interfere at a beam splitter. The bosonic nature of photons leads, in analogy with the Hong-Ou-Mandel (HOM) effect, to selective pairing of photon holes (photon absences in the fluorescent signals). By the HOM effect, two photon holes with the same polarization end up at the same beam splitter output. As a result, two odd photon number detections at the outgoing beams, which must correspond to two photon holes with different polarizations, herald entanglement creation. The robustness of the Gaussian states is evidenced by the ability to compensate for photon absorption and noise by a moderate increase in the number of photons at the input. We calculate the entanglement generation rate in the ideal, non-ideal and near-ideal detector regimes and find substantial improvement over single-photon schemes in all three regimes. Fast and efficient spin-spin entanglement creation can form the basis for a scalable quantum dot quantum computing network. Our predictions can be tested using current experimental capabilities.

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