Quantum communications with highly entangled photons

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The desire to employ entangled photons for quantum information processing tasks has encouraged efforts to enhance the degree of entanglement. This is achieved by extending the size of the state-space that can be accessed in experiments. For definiteness, I shall concentrate on time-bin entanglement [1]. I shall present an analysis of the information capacity for such systems including the effects of "real world" losses, efficiencies and dark counts. The surprising result of this is that the data rates achievable may be very high – in excess of 10 bits per photon and approaching, perhaps, as much as 20 bits per entangled photon pair [2].

Our high bit-rate communications can be made secure by running as a novel QKD scheme. The test for security is surprisingly simple, given the very large number of states involved (recall that $2^{10} = 1024$).

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