

# Entanglement can help in classical communication

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(PhysOrg.com) -- When most of us think of entanglement, our minds jump immediately to quantum communication. "Entanglement has become very well known and useful in quantum communication," Robert Prevedel tells *PhysOrg.com*. Prevedel, a scientist at the Institute for Quantum Computing at the University of Waterloo in Ontario, Canada, believes that entanglement can be used in classical communication as well.

"We have found that in certain situations you can use [entanglement](#) to transmit classical information with higher success when using classical channels that are noisy than you could do without." says Prevedel. "This is a novel use for entanglement which seems to have been overlooked until recently."

A team of scientists at Waterloo, including Prevedel, Lu, Matthews, Kaltenbaek and Resch, demonstrated that that it is possible to benefit from entanglement in some classical communication channels. Their work can be found in *Physical Review Letters*: "Entanglement-Enhanced Classical Communication Over a Noisy Classical Channel."

"One of the reasons that entanglement hasn't been thought to be useful for classical communication is that it has been shown to not increase the capacity of a classical channel, which is the ultimate maximum rate of reliable communication" Prevedel explains. "What entanglement can do, though, is reduce the error probability when sending a message with a fixed number of uses of a noisy classical channel."

Prevedel says that the protocol used is fairly simple. "Our demonstration included only two entangled particles and a straightforward classical channel. Entangled photons show nonclassical correlations. Whenever I do a measurement on one of the photons, I will get a similar result for the

same measurement performed on the other photon."

"Sometimes a classical communication channel gets jumbled," Prevedel explains. "We wanted to see if entanglement could be used to more successfully send information across such a noisy channel. With our simple protocol, and by using entanglement, we found that you can improve the success probability from 83% to 90%. That's fairly significant."

For now, the protocol only works on a very particular type of channel. "The situation we started with is very specific," Prevedel points out. "We looked for the channel that would offer us the largest increase in success probability possible. Also, we knew that using entanglement in this manner won't work with every type of classical communication channel."

So far, the work done by the Waterloo team doesn't offer immediate applications for communications. "Our results are more important from a fundamental point of view," Prevedel says. "From a fundamental point of view, this is big news."

Going forward, Prevedel hopes that he and his colleagues can learn more about the benefits that entanglement can have for classical communication. "We want to figure out which classical channels will benefit from it [entanglement], and which will not. We also want to see if there is a way to generalize our findings." Additionally, the group is hoping that they can adapt what they learned to multi-party conversations. "It might be possible to find scenarios in which entanglement could help in three party or four party conversations - moving beyond two party communication."

Overall, though, Prevedel and his colleagues are excited about the new prospects for combining classical communication with entanglement. "We

have shown that entanglement can help in classical communication, a situation where people thought it was useless. Hopefully, our work will spark interest in this research direction, and we can begin to see some applications in the future."

**More information:** R. Prevedel, Y. Lu, W. Matthews, R. Kaltenbaek, and K.J. Resch, "Entanglement-Enhanced Classical Communication Over a Noisy Classical Channel," *Physical Review Letters* (2011). Available online: [link.aps.org/doi/10.1103/PhysRevLett.106.110505](https://link.aps.org/doi/10.1103/PhysRevLett.106.110505)

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