Quantum communication through synergy

January 19 2009, By Miranda Marquit

(PhysOrg.com) -- When most people think of quantum communication, they think in terms of private communication channels - the ability to send messages without a third-party deciphering them. Indeed, quantum cryptography represents a method of sending information that cannot be eavesdropped upon. Without the proper key for decoding the intercepted message, all an interloper would receive is gibberish. To make quantum cryptography work, Graeme Smith tells *PhysOrg.com*, “We try to understand the protocols and use specially designed channels to send messages and also to shed light on the general theory of privacy in quantum mechanics.”

Conventional wisdom, when applied to quantum communication, seems to say that one must have a private channel in order to communicate privately. Nonprivate channels, the thinking goes, should not be able to send quantum information. It is this very thinking that Smith, along with colleague John Smolin, at the IBM T.J. Watson Research Center in Yorktown Heights, New York, could be overturning. In theory, and with the help of some mathematical equations, Smith and Smolin show that it might be possible to combine nonprivate channels to create a channel that would transmit quantum information - and communicate privately at greater distances than currently possible. Their reasoning can be found in *Physical Review Letters*: “Can Nonprivate Channels Transmit Quantum Information?”

“If you had a channel that didn’t allow you to communicate privately,” Smith points out, “you would think you have a weak resource. But when you start looking at these channels, and you start looking at their limits, you begin to see something else." This "something else," Smith continues, includes qualities that allow nonprivate channels to combine in a way that allows them to possibly become useful for quantum communication.

"There are these features that allow the some of the nonprivate channels to interact with each other in a synergestic way to become useful. Interestingly, this is not something that happens classically. But it could happen with quantum information channels."

Smith says that even though individually these channels might look weak, when they are put together, it is possible that they would have the ability to carry more quantum information than the sum of their individual capacities combined. "In our paper, we are presenting ideas of how to design protocols that allow higher rates of quantum communication, over longer distances, than what we can currently do right now."

Even though this method of quantum communication looks promising, Smith admits that not all of the components are properly understood. Like so much in quantum mechanics, it appears that something *could* or *does* happen, but the *why* isn't always easy to grasp. "Right now," he says, "we're trying to better understand the individual resources, and some of their bounds. We are trying to develop a way to quantify what the resources actually are. We're starting to develop a feel for what different classes of channels might be made of, but we don't have good characterization yet."

Part of understanding characterization, and quantifying the components of quantum communication, Smith continues, is the idea of figuring out the why behind this phenomenon. "We have information that shows that some of these nonprivate channels are useless for quantum communication, but when you combine them, they are quite useful. Why is this?”

“There is something strange going on here. But if we can get to the bottom of it, we should be able to improve upon our ability with quantum communication dramatically.”

Citation: Quantum communication through synergy (2009, January 19) retrieved 10 April 2024 from https://phys.org/news/2009-01-quantum-synergy.html