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Quantum Counterfactual Information Transmission Without a Weak Trace DAVID ARVIDSSON SHUKUR, CRISPIN BARNES, Univ of Cambridge — The classical theories of communication rely on the assumption that there has to be a flow of particles from Bob to Alice in order for him to send a message to her. We have developed a quantum protocol that allows Alice to perceive Bob's message "counterfactually". That is, without Alice receiving any particles that have interacted with Bob. By utilising a setup built on results from interaction-free measurements and the quantum Zeno effect, we outline a communication protocol in which the information travels in the opposite direction of the emitted particles. In comparison to previous attempts on such protocols, this one is such that a weak measurement at the message source would not leave a weak trace that could be detected by Alice's receiver. Whilst some interaction-free schemes require a large number of carefully aligned beam-splitters, our protocol is realisable with two or more beam-splitters. Furthermore, we outline how Alice's obtained classical Fisher information between a weak variable at Bob's laboratory is negligible in our scheme. We demonstrate this protocol by numerically solving the time-dependent Schrödinger Equation (TDSE) for a Hamiltonian that implements this quantum counterfactual phenomenon.

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