Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Quantum correlations beyond Tsirelson's bound DOMINIC BERRY, Macquarie University, MARTIN RINGBAUER, ALESSANDRO FEDRIZZI, ANDREW WHITE, The University of Queensland — Violations of Bell inequalities show that there are correlations that cannot explained by any classical theory. Further violation, beyond Tsirelson's bound, shows that there are correlations that are not explained by quantum mechanics. Such super-quantum correlations would enable violation of information causality, where communication of one bit provides more than one bit of information [Nature 461, 1101 (2009)]. An unavoidable feature of all realistic Bell inequality experiments is loss. If one postselects on successful measurements, unentangled states can violate Bell inequalities. On the other hand, loss can be used to enhance the violation of Bell inequalities for entangled states. This can improve the ability to distinguish between entangled and unentangled states, despite loss. Here we report an optical experiment providing maximal violation of the CHSH-Bell inequality with entangled states. Due to loss and postselection, Tsirelson's bound is also violated. This enables us to more easily distinguish between entangled and unentangled states. In addition, it provides violation of information causality for the postselected data.

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Date submitted: 09 Jan 2014 Electronic form version 1.4