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Detection and Memory Loophole Closing Chained Bell Test with Trapped Ions[1] STEPHEN ERICKSON, TING REI TAN, University of Colorado / NIST, YONG WAN, PETER BIERHORST, DANIEL KIENZLER, SCOTT GLANCY, EMANUEL KNILL, DIETRICH LEIBFRIED, DAVID WINELAND, NIST — Several recent groups have performed loop-hole free violations of Bell's inequality, rejecting with high confidence theories of complete local realism, though they are limited in the extent to which their results differ from local realism. Using a pair of entangled Be+ ions to test the chained Bell inequality (CBI), we put an upper bound of 0.327 (95% confidence) on the fraction of our system that could in principle still be explained by local realism. This is significantly lower than 0.586, the lowest possible upper bound attainable from a perfect Clauser-Horne-Shimony-Holt inequality experiment. Furthermore, this is the first CBI experiment to close the detection and memory loopholes and the first on massive particles. This work was supported by IARPA and the NIST quantum information program.

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