

Abstract Submitted  
for the DAMOP10 Meeting of  
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**Private random numbers produced by entangled ions and certified by Bell's theorem**<sup>1</sup> DAVID HAYES, DZMITRY MATSUKEVICH, PETER MAUNZ, CHRIS MONROE, JQI and University of Maryland, STEVEN OLSCHENK, NIST — It has been shown that entangled particles can be used to generate numbers whose privacy and randomness are guaranteed by the violation of a Bell inequality [1,2]. The authenticity of the bit stream produced is guaranteed when the system used can close the detection loophole and when the entangled particles are non-interacting. We report the use of remotely located trapped ions with near perfect state detection efficiency as a private random number generator. By entangling the ions through photon interference and choosing the measurement settings using a pseudo-random number generator, we measure a CHSH correlation function that is more than seven standard deviations above the classical limit. With a total of 3016 events, we are able to certify the generation of 42 new random numbers with 99% confidence. [1] S. Pironio et al.(submitted to Nature, arXiv:0911.3427) [2] Colbeck, R. PhD Dissertation (2007)

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