Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Quantum Random Numbers Guaranteed by Kochen-Specker Theorem MARK UM, XIANG ZHANG, JUNHUA ZHANG, YE WANG, YANG-CHAO SHEN, Center for Quantum Information, Institute for Interdisciplinary Information Sciences, Tsinghua University, Beijing 100084, P. R. China, DONG-LING DENG, LU-MING DUAN, Michigan Center for Theoretical Physics and Department of Physics, University of Michigan, Ann Arbor, MI 48109, USA, KIHWAN KIM, Center for Quantum Information, Institute for Interdisciplinary Information Sciences, Tsinghua University, Beijing 100084, P. R. China, CQI TEAM — We present a random number generator certified by Kochen-Specker (KS) theorem with a trapped ion system. Outcomes of quantum theory are intrinsically random and can be used to produce genuine randomness. In real implementation, however, the true randomness is inevitably mingled with classical noise or control imperfection and cannot be decisively certified. The KS inequality differentiates the results of quantum mechanics from those of classical theory, non-contextual in nature. We demonstrate the experimental violations of the KS inequality, in particular, the Klyachko-Can-Binicioglu-Shumovsky (KCBS) inequality without the detection loophole and reasonably without the compatibility loophole. The violations are used to certify the randomness of a generated string. As a proof of principle, we produce 1×10^5 random numbers that contain 5.2×10^4 bits of minimum entropy. This work was supported by the National Basic Research Program of China Grant 2011CBA00300, 2011CBA00301, 2011CBA00302, the National Natural Science Foundation of China Grant 61073174, 61033001, 61061130540. KK acknowledges the support of the Thousand Young Talents plan.

Mark Um
Center for Quantum Information,
Institute for Interdisciplinary Information Sciences,
Tsinghua University, Beijing 100084, P. R. China

Date submitted: 14 Mar 2013 Electronic form version 1.4