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Exponential gain of randomness certified by quantum contextuality MARK UM, JUNHUA ZHANG, YE WANG, PENGFEI WANG, KIHWAN KIM, Tsinghua University — We demonstrate the protocol of exponential gain of randomness certified by quantum contextuality in a trapped ion system. The genuine randomness can be produced by quantum principle and certified by quantum inequalities. Recently, randomness expansion protocols based on inequality of Belltext [1] and Kochen-Specker (KS) theorem [2], have been demonstrated. These schemes have been theoretically innovated to exponentially expand the randomness and amplify the randomness from weak initial random seed [3]. Here, we report the experimental evidence of such exponential expansion of randomness. In the experiment, we use three states of a 138Ba+ ion between a ground state and two quadrupole states. In the 138Ba+ ion system, we do not have detection loophole and we apply a methods to rule out certain hidden variable models that obey a kind of extended noncontextuality [4]. [1] S. Pironio, et al., Nature 464, 1021 (2010). [2] Mark Um, et al., Sci. Rep. 3, 1627 (2013). [3] Carl Miller and Yaoyun Shi, arxiv:1411.6608v3 (2015). [4] Otfried Guhne, et al., Phys. Rev. A 81, 022121 (2010).

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