TAILORING MICROCAVITY LASERS FOR PARALLEL ULTRAFAST RANDOM BIT GENERATION

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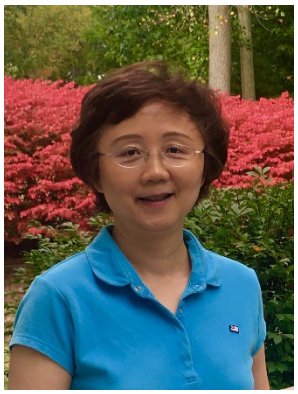

Abstract

Random numbers are widely used for information security, cryptography, stochastic modeling, and quantum simulations. Key technical challenges for physical random number generation are speed and scalability. We demonstrate a method for ultrafast generation of hundreds of random bit streams in parallel with a single laser diode. Spatio-temporal interference of many lasing modes in a specially designed microcavity is introduced as a scheme for greatly accelerated random bit generation. Spontaneous emission, caused by quantum fluctuations, produces stochastic noise that makes the bit streams unpredictable and nonreproducible. We achieve a total bit rate of 250~Tb/s with off-line post-processing, which is more than two orders of magnitude higher than the current post-processing record. Our approach is robust, compact, energy efficient, and should impact applications in secure communication and high-performance computation.

Bio

Hui Cao is the John C. Malone Professor of Applied Physics, a Professor of Physics, and a Professor of Electrical Engineering at Yale University. She received her Ph.D. degree in Applied Physics from Stanford University. Prior to joining the Yale faculty, she was on the faculty of Northwestern University. Her technical interests and activities are in the areas of mesoscopic physics, complex photonic materials and devices, nanophotonics, and biophotonics. Cao is a Fellow of IEEE, AAAS, APS and OSA, and an elected member of the National Academy of Sciences, and the American Academy of Arts and Sciences.