Unpolarized single-photon generation with true randomness from diamond

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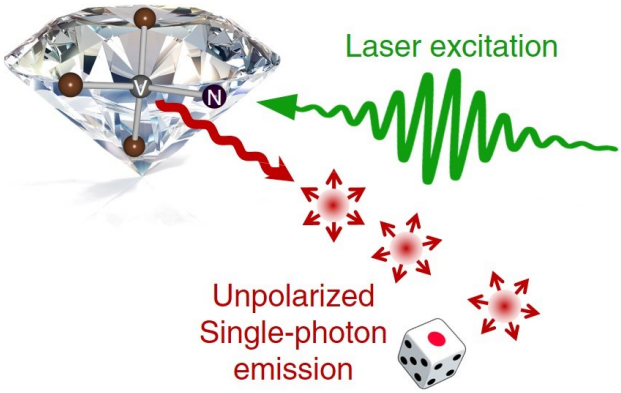

Schematic picture of unpolarized single-photon generation using a compound defect, a nitrogen vacancy center (NV center), in a diamond. Spheres, designated N and V respectively, indicate a nitrogen atom and a vacancy which comprises an NV center in the diamond lattice. Dynamically and statically unpolarized single-photon emission is induced by laser excitation for a [111]-oriented NV center in (111) diamond. Credit: Naofumi Abe

The Tohoku University research group of Professor Keiichi Edamatsu and Postdoctoral fellow Naofumi Abe has demonstrated dynamically and statically unpolarized single-photon generation using diamond. This result is expected to play a crucial role in hardware random number generation using single photons (quantum dice or quantum coin toss), quantum cryptography and the testing of fundamental problems in quantum mechanics.

Quantum information technology, such as quantum computing and quantum cryptography, has the potential to exceed classical information technology in security and capability. In quantum information technology, single photons play an especially important role.

A unit of quantum information is a quantum bit or qubit. It is a two-state quantum-mechanical system, such as the polarization of a single photon. Conventional research had been focused on the generation of single photons in pure polarization states. But now, the team from Tohoku University has, for the first time, generated single photons in random polarization states.

In their paper, published in *Scientic Reports*, the authors present the first demonstration that single-photon emission from a specially oriented compound defect (a nitrogen vacancy center) in diamond is dynamically and statically unpolarized with intrinsic randomness.

More information: Naofumi Abe et al, Dynamically unpolarized single-photon source in diamond with intrinsic randomness, *Scientific Reports* (2017). DOI: 10.1038/srep46722

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