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Quantum Imaging Technology to Reduce X-Ray Dosage & Improve Sensitivity

Stanford researchers have developed a method that allows X-ray and CT imaging to achieve the same signal with two to three orders of magnitude less X-ray dosage.

X-ray is a broadly used imaging modality with a large market of users for many healthcare applications. Its primary disadvantage is that this ionizing radiation can be harmful to the patients and healthcare providers that are exposed. Unfortunately, to have a high enough sensitivity to observe subtle absorption/transmission differences in the sample requires enough high X-ray photon doses which in many cases is enough radiation to be damaging.

The method invented here lowers the amount of radiation required by using Compton scattering through a thin carbon target with a pulsed X-ray source to produce an X-ray and an electron which are measured in coincidence. Because the electron and photon are entangled, the detection of the electron means the X-ray photon exists. This quantum concept changes the statistics of the detection allowing a reduction of the number photons required to detect the same absorption/transmission difference from 10,000 photon/pixel to 100 photons/pixel for a 1% difference (2-3 orders of magnitude improvement).

Stage of Development: Concept

Applications

- Diagnostic imaging by X-ray and CT

Advantages

- Reduces X-ray dose 2-3 orders of magnitude for medical image
- Improves imaging sensitivity for a given dose

Innovators

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