Fundamental measurement technology to support quantum communication and precise optical measurement

Direct observation of ultra-broadband squeezed light with photon number resolving detector

The broad band light sources are expected to realize high-capacity optical communication, optical coherence tomography, optical spectroscopy, and quantum metrology. Squeezed light is a candidate that may serve as a quantum counterpart, however its detection and non-classical characterization at the telecom band have been challenging tasks. Here we demonstrate the direct detection of photon number distribution of the squeezed light with a high efficiency photon number resolving detector (PNRD). The PNRD is based on transition edge sensors with titanium/gold bi-layered superconducting films, which are embedded in an optical absorption cavity. High efficiency of 90 % at the telecom wavelengths and a fast response time of 200 ns are possible. We have directly observed the squeezed light with the PNRD, and have confirmed that the even-photon number distribution is spreading in wide wavelength band width up to 100 nm. Our results and techniques open up a new possibility to characterize non-classical light sources for quantum communication technology.

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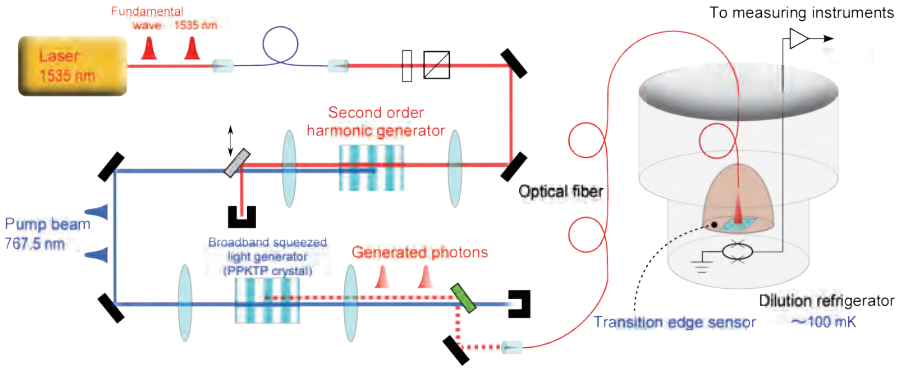

Experimental setup for direct photon number distribution observation of squeezed light

Rapid extraction of radiocesium dissolved in water

Nonwoven fabric cartridge filters impregnated with potassium zinc ferrocyanide

We have developed a cartridge filter including a nonwoven fabric impregnated with potassium zinc ferrocyanide for effectively collecting dissolved radiocesium in water. Experiments with ^{137}Cs concentration conditioned water showed that the cartridge filter could absorb more than 96 % of dissolved ^{137}Cs from the 20 L water at a 2.5 L/min flow rate, and the recovery efficiency did not deteriorate under 3-10 of pH value condition. Measurement test of ^{137}Cs radioactivity concentration in river water indicated that the cartridge filter could apply to natural water monitoring because the detected ^{137}Cs radioactivity by the cartridge filter agreed with that by evaporative concentration within the counting error of the detector.

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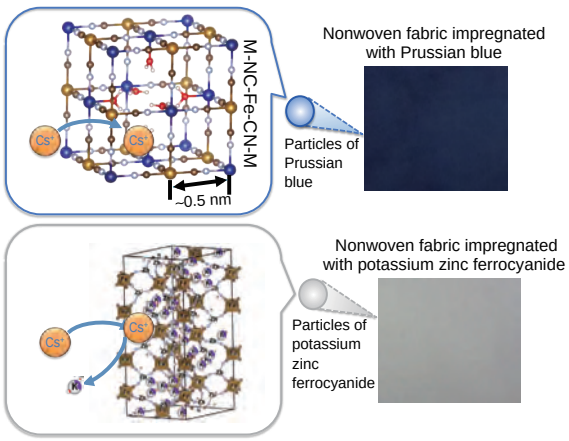
Nonwoven fabric cartridge filter impregnated with potassium zinc ferrocyanide



Adsorption mechanism of the cesium to Prussian blue (upper) and potassium zinc ferrocyanide (lower)