Detecting Pulsed Neutrons by using Current-Biased Kinetic Inductance Detector and 10B convertor

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Neutrons are quite useful in the wide fields of material science, physics, chemistry, biology, agriculture and spintronics, but are not so easy to detect it due to the absence of the electric charge. For example, the ionization gas detector used widely used as a neutron detector, but it requires a very high voltage to operate it. We proposed a superconducting nanowire detector with 10B conversion layer for detecting neutrons. One can use one of two (7Li and 4He) ions emitted in opposite direction to excite the detector. The operating principle is to sense a time derivative of the kinetic inductance Lk caused by a chance in the density of Cooper pairs. Our detector is of advantage to work at 4 K when the wire is biased by a constant DC current. This is different from a microwave kinetic inductance detector (MKID), and we name it a current-biased kinetic inductance detector (CB-KID) [1,2,3]. We succeeded in measuring a clear signal from a single neutron, and the averaged neutron flux from pulsed neutrons (at BL10 of J-PARC) as a function of time. A histogram of averaged neutron in 0.1 ms is in good agreement with that obtained by a Monte-Carlo simulation. We obtained convincing evidence that our detector successfully detected pulsed neutrons from J-PARC. We also verfied that our method works well for the use of the two-dimensional position sensitive

measurements of neutrons. We are able to construct a superconducting neutron imager by the CB-KIDs.

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