

Detectors for nuclear resonant scattering experiments

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Silicon avalanche-photodiode (Si-APD) timing detectors have been developed for nuclear resonant scattering using synchrotron X-rays. The Si-APD detector shows a good time resolution of 50 ps to 1 ns, and a wide dynamic range of count-rate, 10^9 - 10^{10} . Nuclear resonant scattering using synchrotron X-rays is now extending its application to a higher energy region of nuclear levels. However, due to a small photoabsorption cross section of Si ($Z=14$) at energies higher than 10 keV, the detector efficiency sharply decreased to less than 1% for a 100- μm thick APD at 50 keV, for example. To improve the efficiency for a high-energy photon, we can use Si-APDs with a stacked and/or inclined arrangement. A scintillation detector with a fast light-emission is also expecting for timing measurements. In scintillators by exciton recombination in semiconductors, the lead-halide based perovskite-type organic-inorganic hybrid compound has a sub-nanosecond decay component and a relatively high light output, about 10% of NaI(Tl), even at room temperature. We are now investigating its property with synchrotron X-rays. The results in the test measurements will be presented at the workshop.