Laser Compton Scattering Gamma-Ray Beam Source for Nuclear Physics and Material Research

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Abstracts: *Laser Compton scattering gamma-ray beam source has been developed at the NewSUBARU synchrotron light facility. The available maximum Gamma-ray photon energy is 76 MeV. The flux of quasi-monochromatic gamma-ray photons (for example: 16.7 MeV, ΔE/E~5%) is more than 10^6 photons/sec using a 30 W Nd:YVO_4 laser combined with the 1 GeV storage electron beam with an intensity of 300 mA. Gamma-ray beams were used for application experiments, a nuclear physics research, a nondestructive inspection of thick material, a generation of positron by pair creation, a magnetic Compton scattering measurements, and a nuclear transmutation.*

The laser Compton scattering (LCS) γ-rays have advantages that an energy tunable quasi-monochromatic and an almost 100% linearly (circularly) polarized γ-ray beam. The polarized γ-ray beams are powerful tools to study the material science and the nuclear physics such as a magnetic Compton scattering, polarized electron and positron generation, and measurement of transition strengths with parity assignments. The (γ, n) reactions with linearly polarized beam have not been studied well, since the 100% linear polarized photon beam has not been practically used before the developments of the LCS γ-ray facilities.

The synchrotron light facility NewSUBARU [1] is operated by the LASTI, University of Hyogo, Japan. The LCS gamma-ray beam-line BL01 [2] was started to operate from 2005 using the 0.5–1.5 GeV electron beams in the NewSUBARU storage ring. Lasers with different wavelengths are used to produce the LCS photon beam in the energy range from 0.5 MeV to 76 MeV. A experimental hutch, GACKO [3] (Gamma Collaboration Hutch of Konan University), was added to use at the BL01. Figure 1 shows a schematic layout of LCS gamma-ray beam-line.

Recently, we have measured the photo neutron distribution emitted from the interaction between linearly polarized gamma-rays and nuclei [4]. This was the first demonstration of a theory of photo-neutron emission which depend on the polarization.

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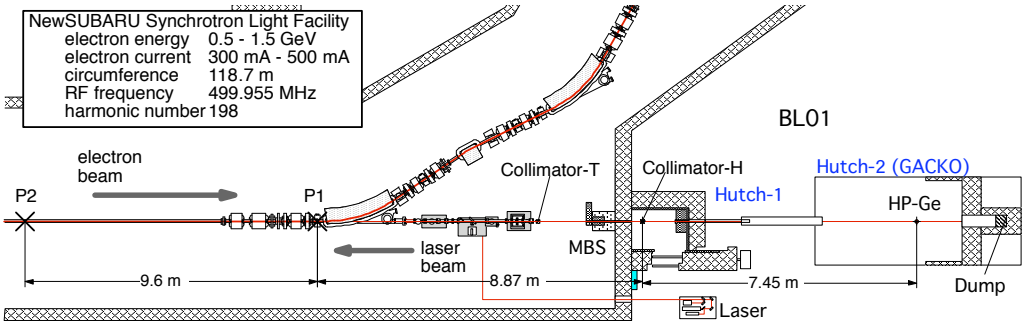
Fig.1



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