$2\pi^0$ photoproduction experiment at SPring-8

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The π-π correlation in nuclear medium with the I=J=0 state is one of the important topics to be investigated in hadron physics, since it is related with the scalar iso-scalar σ meson corresponding to the amplitude fluctuation of the scalar quark-condensate. Hatsuda *et al.* have been reported that the chiral symmetry can be partially restored even for the normal nuclear density and predicted that as a result of partial restoration of chiral symmetry, the σ meson mass distribution in nuclear medium shows an enhancement near the 2π threshold[1]. Therefore one may have a chance to observe precursory phenomena of chiral symmetry restoration by measuring the $\pi\pi$ mass spectrum in nuclear medium.
Recently, several experimental results of pion-induced 2π production off nuclear targets have been reported[2,3]. In comparison with a pion beam, a photon beam has an advantage because it probes the whole/entire nuclear volume and therefore one can effectively probes a higher density region. The $\pi^0\pi^0$ channel is better to be investigated in this study because of no background coming from ρ^0 meson decay which gives a huge background to the $\pi^+\pi^-$ channel. Therefore the experiment of $2\pi^0$ photoproduction off nuclear targets is much attractive.

To investigate this subject, we have been performing a series of experiments at SPring-8. We use a Laser-Electron Photon beam at SPring-8(LEPS) which is obtained by means of backward Compton scattering of laser photons and 8 GeV storage electrons[4]. The photon energy ranges from 1.5GeV to 2.4GeV.
To detect multi photons coming from $\pi^0\pi^0$ decay, we employ an electro-magnetic calorimeter, a detector assembly consisting of 252 modules of lead scintillating fiber (Lead/SCIFI) blocks. The calorimeter covers the angular region from 30° to 100° for the polar angle, and from 0° to 360° for the azimuthal angle. It corresponds to the solid angle of 2.08π(sr).

The first experiment of $2\pi^0$ photoproduction off nuclear targets was performed in December, 2001. We used CH_2, C, Cu, and W as a target nucleus. In this contribution, the results of data analysis for the experiment will be discussed.

References

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