Coherent ϕ-Meson Production from Deuterons near Threshold with Linearly-Polarized photon beams

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The LEPS (Laser Electron Photons at SPring-8) experiment generates real photon beam of maximum energy 2.4 GeV with high degree of linear polarization by Compton backscattering. We study the reaction mechanisms of diffractive photoproduction of ϕ mesons from protons and deuterons near threshold energy. The unique feature of photoproduction of ϕ-meson, compared to that of the other vector mesons like ρ and ω, the meson exchange in t-channel is OZI suppressed due to the ssbar quark content of ϕ. In addition the measurement of the spin variables using the linearly-polarized photon beam can determine the relative importance of contributions from the natural-parity exchange, e.g. Pomeron trajectory and those of unnatural-parity π and η-meson exchange.

It was found[1] that a local structure of the differential cross sections at zero degree of diffractive ϕ-meson photoproduction from protons could not be explained by the appearance of the unnatural-parity processes at low energies only but together with a new dynamics of natural-parity exchange beyond Pomeron. This issue could be further investigated in the ϕ-meson coherent production from deuterons. Since the isospin of deuteron is zero, the isovector π-exchange, as the main component of unnatural-parity exchange processes, is forbidden. Therefore the natural-parity exchange processes are expected to play a significantly dominating role in the reaction.

In this talk, we will present the first measurement of diffractive coherent ϕ-meson photoproduction from liquid deuterium in the very forward direction at low energies near threshold by SPring-8/LEPS experiment. Combining the results of differential cross sections and decay asymmetry, strong evidence of new natural-parity exchange processes other than standard Pomeron trajectory is seen.

[1] T. Mibe, W.C. Chang, *et al.* , Phys. Rev. Lett. **95**, 182001 (2005)