



Contribution ID: 69

Type: Oral

Observation of the isovector dibaryon resonance-like state with mass of $2.18 \text{ GeV}/c^2$

Monday, 31 August 2015 17:15 (15 minutes)

The pion production in proton-proton collisions with formation of the final-state $1S_0$ proton pair has been studied at ANKE-COSY. The angular dependence of the differential cross section has a forward dip in the whole energy region, its energy dependence reveals a clean peak in the $\Delta(1232)$ resonance region. The analyzing power is found significant, the maximal value of its angular dependence varies from 0.3 to 0.8 at different energies. A partial wave analysis assuming essential contribution of only two amplitudes, MP s and MPd , shows a resonance behavior of the d-pion wave amplitude with Breit-Wigner parameters $E_R = 2181 \pm 8 \text{ MeV}/c^2$ and $\Gamma = 108 \pm 24 \text{ MeV}/c^2$. The peak in the forward cross section energy dependence looks as a direct manifestation of a ΔN resonance state in the P-wave of its relative motion. Position of the resonance indicates a strong attractive ΔN interaction in the $JP = 2^-$ state. The s-wave transition amplitude has a value comparable with the d-wave amplitude and due to interference causes the observed dip in the forward cross section and significant analyzing power. The s-wave amplitude squared reveals a resonance-like energy dependence similar to that of the d-wave.

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Session Classification: Hadron Structure, Spectroscopy, and Dynamics II