

Evidence for Formation of $K_S^0 p$ Resonances in (Anti)Neutrino Interactions

A.E. Asratyan, A.G. Dolgolenko, and M.A. Kubantsev *

*Institute of Theoretical and Experimental Physics,
B. Chermushkinskaya 25, Moscow 117259, Russia*

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Three baryon resonances with masses of 1532 ± 2 , 1577 ± 3 , and 1659 ± 5 MeV are observed in invariant mass of the $K^0 p$ system formed in neutrino and antineutrino collisions with deuterons and neon nuclei. The Σ^{*+} hypothesis for either of these three resonances is disfavored by the data on associated Λ hyperons and on formation of the $\Lambda\pi$ and $\Lambda\pi\pi$ systems. Observed widths of the 1532-MeV and 1577-MeV resonances are consistent with being entirely due to instrumental smearing of the $K^0 p$ mass, $\sigma_m \simeq 7$ MeV. For the 1659-MeV resonance, a nonvanishing intrinsic width on the order of $\Gamma \sim 20\text{--}30$ MeV is suggested by the data. These resonant states are tentatively interpreted as the recently discovered pentaquark baryon $\Theta^+(1530)$ and its spin/isospin partners. The analysis is based on the data obtained in past neutrino experiments with big bubble chambers: WA21, WA25, WA59, E180, and E632.

*Now at Department of Physics and Astronomy, Northwestern University, Evanston, IL60208, USA.