On possible existence of dibaryon resonance $d_1^\star$ and its role in the $np\gamma$ and $pd\gamma$ processes below the pion threshold.

A.S.Khrykin

Joint Institute for Nuclear Research, Dubna, 141980 Russia

Recent experimental results [1] on search for NN-decoupled dibaryon resonances using the reaction $pp \to pp\gamma\gamma$ [2, 3] at an energy below the pion production threshold are reported. The energy spectrum of high energy γ-rays ($E_\gamma \geq 10$ MeV) emitted at 90^0 in the laboratory from the reaction explored has been measured at an proton energy of about 216 MeV. The measured spectrum shows strong evidence for the existence of an NN-decoupled dibaryon resonance called $d_1^\star$ with a mass of about 1956 MeV that is produced in the radiative process $pp \to \gamma\ d_1^\star$ and subsequently decays via the $d_1^\star \to pp\gamma$ electromagnetic channel. The existence of the $d_1^\star$ resonance means that along with the conventional mechanisms of photon production in NN collisions below the pion production threshold there should be one more, new, resonant mechanism. We point out that this mechanism can give a significant contribution to the $NN\gamma$ process in some regions of photon energies (angles). In this connection the available energy spectra for high energy γ-rays emitted at an angle of 90^0 in the laboratory from the reactions $np \to \gamma X$ [4] and $pd \to \gamma X$ [5, 6] measured at energies below the pion production threshold have been analyzed. We note that the general characteristic shape of these spectra in the energy range 45 - 75 MeV is similar to that expected from the $d_1^\star$ decay. It has been shown that puzzling discrepancies between experimental data [5, 6] and theoretical calculations [7] can reasonably be explained by the fact that the calculations did not take into account the contribution from the resonant mechanism of photon production in question. Upper limits for the NN-decoupled dibaryon production cross section in the mass region below the pion threshold for the reaction $pd \to pdX$ and $pd \to ppX$ [8] have been determined.

References

[1] A. S. Khrykin et al., Phys. Rev. C **64**, 034002(2001).

[2] S. B. Gerasimov and A. S. Khrykin, Mod. Phys. Lett. **A8**, (1993)2457.

[3] S. B. Gerasimov, S. N. Ershov, A. S. Khrykin, Phys. At. Nucl.**58**, (1995)844.

[4] F. Malek et al.,Phys.Lett. **B 266**, 255(1991).

[5] J.A. Pinston, et al.,Phys.Lett. **B 249**, 402(1990).

[6] J. Clayton, et al., Phys. Rev. C **45**, 1810(1992).

[7] K. Nakayama, Phys. Rev. C **45**, 2039(1992).

[8] A. Tamii et al., Phys. Rev. C **65**, 047001(2002).