ON POSSIBILITY OF OBSERVING QUARK OSCILLATOR EXCITATIONS IN DEUTERON NUCLEUS

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There are at least three independent experimental evidences for existence of oscillator excitation levels in deuteron. The first one is contained in paper [1] where deuteron-deuteron scatterings at 8.9 GeV/c momentum of primary deuterons and big transfer momenta were studied. Usually it is taken for granted that two distinct peaks observed there correspond to elastic *d–d* and *d–N* scatterings. Our calculations [2] revealed that it is not the case (see Fig.1).

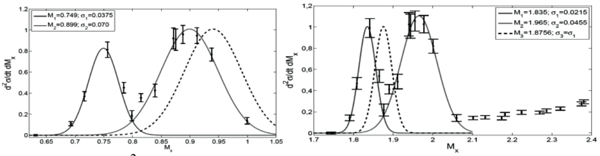

Fig.1.Effective mass (GeV/c^2) distribution of particle X for $d + d \to X + d$ reaction. Theoretical peaks for $X = p$ and $X = d$ are shown by dashed lines in the left and right pictures. Experimental data are taken from [1]. Parameters of their normal distribution interpolation shown by solid lines are also given.

Additional study shows that the experimental peaks may be described perfectly well if one assumes that they correspond to transitions between different oscillator levels described by the following formula $M_n = M_d + 10.08\,n,\ \ n = 1,2,...,$ where masses are taken in MeV/c^2. The second experimental evidence for existence of oscillator excitation levels in two-nucleon system came from [3], where dibaryon resonances were observed in *p–p* system obtained by "deeply cooling" highly excited *n–p* system. It can be checked that all these dibaryons are located on the straight line $M_n = M_d + \Delta M + 10.08\,n,\ \ n = 1,2,...,$ where $\Delta M = 2M_p - M_d$. The third type of possible oscillator excitations in *n–p* system was found in EVA experiment data [4]. These data bear a strong likeness between highly excited states of *n–p* system and coherent superposition of dibaryons with masses described by the afore-cited formula. They also help to explain the surprising peak positions shown above in the pictures. Furthermore, it can be shown that these data give an encouraging evidence for observing nucleons-to-quarks phase transitions in the EVA experiment (see [5]).

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3. Yu.A.Troian // Phys. Part. Nucl. 1993. V.24. P.294.
4. A.Tang *et al*. // Phys. Rev. Lett., 2003. V.90. 042301.
5. B.Kostenko // arXiv:1902.052052 v3 [nucl-th].