

**The Mass Spectrum of the Exotic Meson  $0^{--}$ ,  
 $0^{+-}$  and  $2^{+-}$  States  
by the Diquark Cluster Model Calculation  
with  $q^2 \bar{q}^2$  System**

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Model Caluculation.

The mass formula for the Diquark Cluster Model (DCM) based on the Nuclear Shell Model is following .

$$M = m n_T + M(1p_{1/2}) n(1p_{1/2}) + M(1p_{3/2}) n(1p_{3/2}) \\ + M(1d_{3/2}) n(1d_{3/2}) + \Delta_0(n_{\phi_0} + n_{\bar{\phi}_0}) + \Delta_1(n_{\phi_1} + n_{\bar{\phi}_1}) + \Sigma \Delta_{TS}$$

The mass for u and d quark and the parameter of the harmonic oscillator are  $m = \omega = 300$  MeV.

And total quark number is  $n_T = k + h$  , k is quark and h is antiquark number, respectively.

The excitation energy of u or d quark from  $1s_{1/2}$  state to  $1p_{1/2}$  state and to  $1d_{3/2}$  state are  $M(1p_{1/2}) = 150$  MeV and  $M(1d_{3/2}) = 375$  MeV, respectively.

The interaction in the s state diquark cluster for spin 0 is  $\Delta_0 = a - 3/4b$ , and for spin 1 is  $\Delta_1 = a + 1/4b$ , and  $a = 187$  MeV,  $b = 195$  MeV.

The interaction parameters for the p state quark-quark interaction in the diquark cluster are  $\Delta_{00} = \Delta_{11} = \Delta_{01} = 0$ ,  $\Delta_{10} = - 60$  MeV.

The first suffix of  $\Delta$  represents an isospin and second one is a spin respectively<sup>1)</sup>.

<sup>1)</sup> Y.Uehara, N.Konno, H.Nakamura and H.Noya:  
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