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Possible interpretation of $N(1685)$

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$N(1685)$ was firstly reported in the photoproduction of η meson off the quasi-free neutron. Unlike other low-lying nucleon resonances whose Breit-Wigner (BW) widths are at least 100 MeV, the BW width of the $N(1685)$ is less than 30 MeV. The interpretation of the $N(1685)$ is still an open question.

The non-strange pentaquark mass of all quark configurations is evaluated in a constituent quark model, where the Cornell potential is employed and all model parameters are predetermined by comparing the theoretical and experimental masses of low-lying baryons which are believed to be mainly $3q$ states. The state with the $[31]_{FS}[22]_F[31]_S(q^4\bar{q})$ configuration and quantum numbers $I(J^P) = \frac{1}{2}(\frac{1}{2}^-)$ is predicted to be the lowest pentaquark state. Its mass is derived about 1670 MeV, which encourages one to expect that the $N(1685)$ could be the lowest pentaquark state.

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