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Shedding light on Hexaquarks

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Several new findings in the four, five and six quark systems reheat the interest in the field of multiquark states (beyond trivial $q\bar{q}$ and qqq). A lot of progress has recently been made in the 6q sector, on both the theoretical and experimental side. A resonance like structure observed in double-pionic fusion to the deuteron, at M=2.38 GeV with $\Gamma = 70$ MeV and $I(J^P) = 0(3^+)$ has been consistently observed in a wealth of reaction channels, supporting the existence of a resonant dibaryon state - the $d^*(2380)$. These studies include measurement of all the principle strong decay channels in pn collisions in the quasi-free mode by the WASA-at-COSY and HADES collaborations.

The internal structure of the $d^*(2380)$ is largely unknown. It can contain various hidden color 6q configurations, $\Delta\Delta$ molecular states with angular momentum L=0,2,4,6 as well as meson-assisted dressed dibaryon structures. The large set of experimental data obtained to date gives some constraints on the internal structure of the $d^*(2380)$ dibaryon, but does not settle the issue. The d^* is the only multiquark state which can be produced copiously at current facilities, offering unique access to information beyond its basic quantum numbers, particularly its physical size and internal structure. The first exciting new results on d^* photoproduction from A2-MAINZ/MAMI will be reported together with the latest results from Wasa-at-Cosy on d^* rare decays. Future plans to improve our understanding of the d* will also be presented, including the exciting possibilities for investigation of the SU(3) multiplet companions and mirror partners of the d^*.

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