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$d^{*}(2380)$ hexaquark: from Photoproduction to Neutron Stars

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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 hexaquark state - the $d^{*}(2380)$. It was recently indicated that this new particle may set a limit on achievable neutron star masses, play a key role in the dynamics of neutron star merger events (including resultant gravitational wave emission) and has the potential to be an important intermediate step in the nuclear to quark-gluon plasma transition.

The talk will present the first results on *d* photoproduction, obtained with the Crystal Ball at MAMI. The new analysis indicated that the $d(2380)$ is likely to be excited predominantly through an $M3$ transition rather than an $E2$ transition, which is consistent with its proposed compact nature. The $d^{*}(2380)$ is likely to be the first genuine hexaquark. Further possible astrophysical implications will also be outlined.

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