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Combined theoretical study of the $D^+ \rightarrow \pi^+ \eta \eta$ and $D^+ \rightarrow \pi^+ \pi^0 \eta$ reactions

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We study the $D^+ \rightarrow \pi^+ \eta \eta$ and $D^+ \rightarrow \pi^+ \pi^0 \eta$ reactions, which are single Cabibbo suppressed and can proceed both through internal and external emission. The primary mechanisms at quark level are considered, followed by hadronization to produce three mesons in the D^+ decay, and after that the final state interaction of these mesons leads to the production of the $a_0(980)$ resonance, seen in the $\pi^+ \eta$, $\pi^0 \eta$ mass distributions. The theory has three unknown parameters to determine the shape of the distributions and the ratio between the $D^+ \rightarrow \pi^+ \eta \eta$ and $D^+ \rightarrow \pi^+ \pi^0 \eta$ rates. This ratio restricts much the sets of parameters but there is still much freedom leading to different shapes in the mass distributions. We call for a measurement of these mass distributions that will settle the reaction mechanism, while at the same time provide relevant information on the way that the $a_0(980)$ resonance is produced in the reactions.

Collaboration

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