Contribution ID : **136**   Type : **parallel talk**

Triangle singularity enhancing isospin violation in $\bar{B}_s^0 \to J/\psi \pi^0 f_0(980)$ **and** $D_s^+ \to \pi^+ \pi^0 f_0(980)$

Friday, 8 June 2018 17:20 (0:25)

Collaboration

Abstract content

We investigate isospin violation and $a_0 - f_0$ mixing in the $\bar{B}_s^0 \to J/\psi \pi^0 a_0(980)(f_0(980))$ and $D_s^+ \to \pi^+ \pi^0 a_0(980)(f_0(980))$ reactions, where $\bar{B}_s^0 \to J/\psi \pi^0 f_0(980)$ and $D_s^+ \to \pi^+ \pi^0 f_0(980)$ are isospin-suppressed while $\bar{B}_s^0 \to J/\psi \pi^0 a_0(980)$ and $D_s^+ \to \pi^+ \pi^0 a_0(980)$ are isospin-allowed. The reaction proceeds via a triangle mechanism, with $\bar{B}_s^0 \to J/\psi K^* \bar{K} + c.c.$ or $D_s^+ \to \pi^+ K^* \bar{K}$, followed by the decay $K^* \to K\pi$ and a further fusion of $K\bar{K}$ into the $f_0(980)$ or $a_0(980)$. We show that the mechanism develops a singularity around the $\pi^0 f_0(980)$ or $\pi^0 a_0(980)$ invariant mass of 1420 MeV where the $\pi^0 f_0$ and $\pi^0 a_0$ decay modes are magnified and also the ratio of $\pi^0 f_0$ to $\pi^0 a_0$ production, stressing the role of the triangle singularities as a factor to enhance the mixing of the $f_0(980)$ and $a_0(980)$ resonances. We calculate absolute rates for the reactions and show that they are within present measurable range. The measurement of these reactions would bring further information into the role of triangle singularities in isospin violation and the $a_0 - f_0$ mixing in particular and shed further light into the nature of the low lying scalar mesons.

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Session Classification :   Parallel Session C4