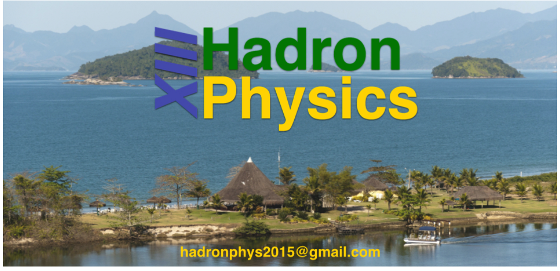

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Calculating the $\mathcal{D}^*$ off-shell case of $g_{\eta_c \mathcal{D}^* \mathcal{D}}$ using the QCD sum rules approach.

In the past few decades, the QCD sum rules (QCDSR) community, has been working actively in the calculation of strong coupling constants of a large variety of interaction vertices between mesons. Particularly, our QCDSR group has been working extensively in the charm sector, with the calculation of a vast number of coupling constants as the $D^* D\pi$, $D^{(*)} D^{(*)}\rho$, $J/\psi D^{(*)} D^{(*)}$ and more recently, the $J/\psi D_s D_s$ and $J/\psi D_s^* D_s$. Continuing this line of research, we started the study of charmed vertices that include the pseudo-scalar meson η_c.

The $\eta_c D^* D$ is one of these vertices. It is related to physical problems of current interest, as the η_c decay in two light vector mesons ($\eta_c \to VV$). Experimental data indicates that this type of decay, as the $\eta_c \to \rho\rho$ and $\eta_c \to K^*(892)\bar{K}^*(892)$, is among the most contributing decay channels for the η_c, with branching ratios of $(1.8 \pm 0.5) \times 10^{-2}$ and $(6.8 \pm 1.3) \times 10^{-3}$ respectively for the mentioned channels. However, these decays should be suppressed by the helicity selection rule (HSR). This is an intriguing problem that shares some similarities with the notorious $\rho\pi$ puzzle, in which the decay $J/\psi \to \rho\pi$ also presents a branching ratio of the order 10^{-2} even though being a suppressed decay according to the OZI rule. One way to circumvent the HSR suppression is to consider the $\eta_c \to VV$ decay with an intermediate step through the mesons D and D^*, i.e. $\eta_c \to D\bar{D}^* \to VV$. In this picture, the coupling constant $g_{\eta_c D^* D}$ will be necessary to the calculation of these decay amplitudes, making it necessary to have a good estimate for this coupling constant.

In this work, we will calculate the $g_{\eta_c D^* D}$ coupling constant using the QCDSR technique for the case where the D^* mesons is considered off-shell. We will take advantage of the similarities between the mesons $D^{(*)}$ and $D_s^{(*)}$ in order to also calculate the $g_{\eta_c D_s^* D_s}$ coupling constant for the D_s^* off-shell case and we will compare both of them according to the SU(4) symmetry.

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