"New exotics" from the $\widetilde{U}(12)_{SF}$-scheme

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In this talk, we have discussed the pionic / kaonic transitions of charmed mesons in the framework of $\widetilde{U}(12)_{SF} \otimes O(3,1)_L$-classification scheme of hadrons, which is proposed and developed in recent years by our collaboration-group. The $U(12)_{SF}$ contains, in addition to the conventional non-relativistic $SU(6)_{SF}$-group ($SU(6)_{SF} \supset SU(2)_\sigma \otimes SU(3)_F$), the new symmetry group $SU(2)_\rho$. By inclusion of this extra $SU(2)_\rho$-spin freedom it leads to the possible existence of some multiplets of "exotic" hadrons, which do not exist in the ordinary non-relativistic quark model.

Possible assignments for observed and predicted $I = 0$ charmed mesons and their calculated pionic / kaonic decay widths are summarized in the following table.

To evaluate the above transition, we have used the effective quark-pion/kaon coupling vertex adopted in the chiral quark model with suitable modification in conformity with our scheme. In the actual calculation, we have taken the zero-recoil approximation considered to be effective for relevant application. For the isospin non-conserving decay processes, we use $\epsilon^2 \approx 0.65 \times 10^{-4}$ as a suppression factor, multiplying the absolute squared amplitudes.

In conclusion, it is indicated that the $D_{s0}(2317)$, $D_{s1}(2460)$, and $D_{s1}(2700)$ are good candidates of $c\bar{s}$ chiral states through their observed mass and decay prpperties. The existence of other broad chiral states should be checked in future experiments.

Table I. Classification of $c\bar{s}$ mesons in $\widetilde{U}_{SF} \otimes O(3,1)_L$-scheme. Pionic / kaonic transition widths (in MeV) are also given. Predicted (, but experimentally missing) states are underlined. Experimental values are taken from the Particle Data Group 2008.

Mesons	${}^{2S+1}L_J; j_q^P$	$(\rho_3(c), \bar{\rho}_3(\bar{s}))$	decay channel	$\Gamma^{\text{theor.}}$	$\Gamma^{\text{exper.}}$
D_s	${}^1S_0; \frac{1}{2}^-$	$(+,+)$	-	-	-
D_s^*	${}^3S_1; \frac{1}{2}^-$	$(+,+)$	$D_s\ \pi^0$	0.0031keV	<110KeV
$D_{s0}(2317)^*$	${}^1S_0; \frac{1}{2}^+$	$(+,-)$	$Ds\ \pi^0$	9.1keV	<3.8
$D_{s1}(2460)$	${}^3S_1; \frac{1}{2}^+$	$(+,-)$	$Ds^*\ \pi^0$	5.1keV	< 1.68
$\underline{D_{s0}(\sim 2480)^*}$	${}^3P_0; \frac{1}{2}^+$	$(+,+)$	$D\ K$	~330	
$\underline{D_{s1}(\sim 2550)}$	$P_1; \frac{1}{2}^+$	$(+,+)$	$D^*\ K$	~178	
$D_{s1}(2536)$	$P_1; \frac{3}{2}^+$	$(+,+)$	$D^*\ K$	0.22	< 2.3
$D_{s2}(2573)$	${}^3P_2; \frac{3}{2}^+$	$(+,+)$	$D\ K, D^*\ K$	16+1=17	20±5
$D_{s1}(2700)$	${}^1P_1; {}^-$	$(+,-)$	$D\ K, D^*\ K$	34+50=84	110±27
$\underline{D_{s1}(\sim 2700)}$	${}^3P_1; {}^-$	$(+,-)$	$D\ K, D^*\ K$	~ 126+54=180	

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