Additional properties of charm radial excitations

Absolute branching fractions?

November 26-28, 2012
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Radial excitations

State	decay		Final state	Angular mom.
D'(2550) $J^P=0^-$ M=2540 MeV Γ=130 MeV	Dπ	No		
	$D^*\pi$	Yes	$D^*\pi$	L=1
	$D_0^*(2400)\pi$	Yes	Dππ	L=0
	$D_1\ \pi$	No		
	$D_2^*(2460)\pi$	Yes	Dππ, $D^*\pi\pi$	L=2
D*'(2600) $J^P=1^-$ M=2610 MeV Γ=93 MeV	Dπ	Yes	Dπ	L=1
	$D^*\pi$	Yes	$D^*\pi$	L=1
	$D_0^*(2400)\pi$	No		
	$D_1\ \pi$	Yes	D*ππ, Dπππ	L=0
	$D_2^*(2460)\pi$	Yes	Dππ, $D^*\pi\pi$	L=2

- Relatively narrow
- L=0 or 1 presumably dominant

BaBar

B(Dπ) / B(D*π)=0.32±0.02±0.09

Production rates in cc events

State	Efficiency (%)	Yield ($x10^{-3}$)	Yield corrected ($x10^{-7}$)
$D_1(2420)^0$	**1.09±0.03**	**214.6±1.2±6.4**	**4.38±0.13±0.19**
$D_2^*(2460)^0$	**1.12±0.04**	**136±2±13**	**4.67±0.45±0.36**
$D'(2550)^0$	**1.14±0.04**	**98.4±8.2±38**	**(1.3±0.5)/** α(D')
$D^{*'}(2600)^0$	**1.18±0.05**	**71.4±1.7±7.3**	**(0.9±0.1)/** α(D*')

BaBar

Final state measured: $D^{*+}\pi^-$

Yield corrected values assume:

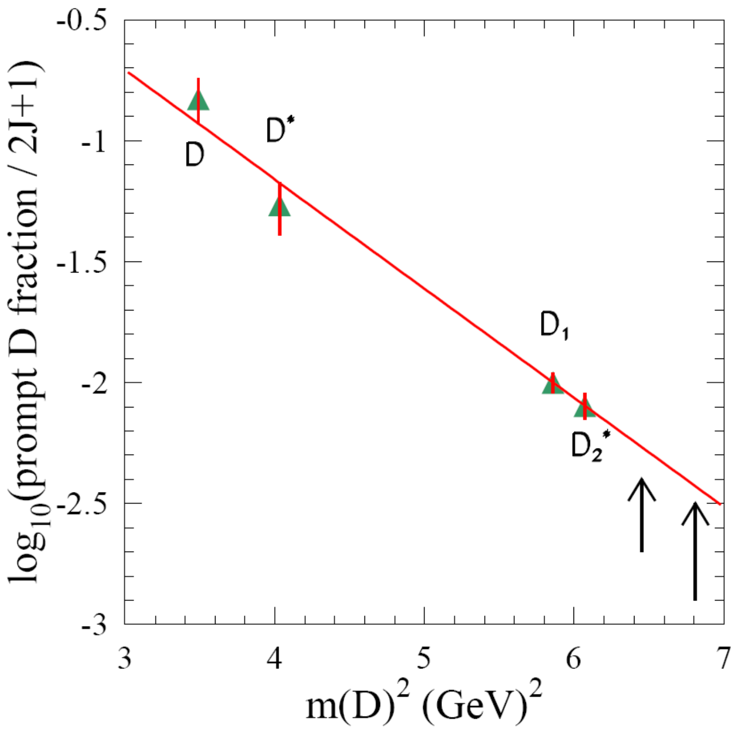
- $B(D_1(2420)^0 \to D^{*+}\pi^-)$ = 0.45±0.02
- $B(D_2^*(2460)^0 \to D^{*+}\pi^-)$ = 0.26±0.02
- $B(D' / D^{*'})^0 \to D^{*+}\pi^-)$ = 2/3 x α

-α is the fraction of the $D^*\pi$ decay final state.

LEP recollections …

Particle prod. in jets can be described using:
$(2J+1) \times \exp(-b\, m^2)$

P($c \to D_1(2420)$) ~ 3 %



- **P($c \to D'$) ~ 0.5%**
- **P($c \to D^{*\prime}$) ~ 1.1 %**
- $\alpha(D')$ = 1.6 ± 0.6 .. rather uncertain
- $\alpha(D^{*\prime})$ = 0.5 ± 0.1

Rather large decay rates of D' and D*' into D*π!

What about B sl decays ?

Can we explain broad D(*)π components in $B^0 \to D^{(*)}\pi l \nu_l$ by the $D^{(*)}$' ?

	(%)
$B_d^0 \to D_1^- \ell^+ \nu_\ell$	0.58 ± 0.05
$B_d^0 \to D_2^{*-} \ell^+ \nu_\ell$	0.29 ± 0.03
$B_d^0 \to [\overline{D}\pi]_{broad} \ell^+ \nu_\ell$	0.42 ± 0.06
$B_d^0 \to [\overline{D}^* \pi]_{broad} \ell^+ \nu_\ell$	0.33 ± 0.07

One expects that $D^{(*)}$'states are less abundant than narrow D** because they have a higher mass (to be checked: decay rate expressions, form factors, …)

- only the D*' can contribute to Dπ (broad)

- upper limit: 0.6 % x ½ x 0.3 ~ 0.1 %

The D*' has a negligible effect in Dπ broad.

- for D*π (broad) there could be $D^{(*)}$' contributions.

- my guess estimate: <0.1% from D', ~ 0.1% from D*' … could be enough

- for $D^{(*)}\pi\,\pi$ (broad) my guess estimate:
<0.1% from D', ~ 0.1% from D*' … this cannot explain the 1.25±0.25 %