

Interpretation of LHCb Hidden-Charm Pentaquarks within the Compact Diquark Model

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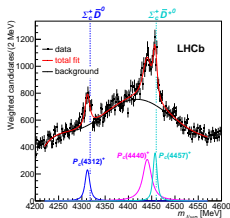
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based on the papers [PLB 793 \(2019\) 365 \[arXiv:1904.00446\]](#)
& [JHEP 10 \(2019\) 256 \[arXiv:1907.06507\]](#)

$\Lambda_b \rightarrow p + J/\psi + K^-$ Decay: 2019 Results by LHCb

- Λ_b -baryon decay $\Lambda_b \rightarrow p + J/\psi + K^-$ was studied on 9 times more data based on Run 1 and 2 than on Run 1
- Three narrow peaks were observed in $m_{J/\psi p}$ distribution

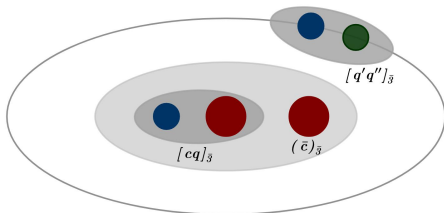
State	Mass [MeV]	Width [MeV]	(95% CL)	\mathcal{R} [%]
$P_c(4312)^+$	$4311.9 \pm 0.7_{-0.6}^{+6.8}$	$9.8 \pm 2.7_{-4.5}^{+3.7}$	(< 27)	$0.30 \pm 0.07_{-0.09}^{+0.34}$
$P_c(4440)^+$	$4440.3 \pm 1.3_{-4.7}^{+4.1}$	$20.6 \pm 4.9_{-10.1}^{+8.7}$	(< 49)	$1.11 \pm 0.33_{-0.10}^{+0.22}$
$P_c(4457)^+$	$4457.3 \pm 0.6_{-1.7}^{+4.1}$	$6.4 \pm 2.0_{-1.9}^{+5.7}$	(< 20)	$0.53 \pm 0.16_{-0.13}^{+0.15}$



- $P_c(4312)$ is a new resonance
 - $P_c(4450)$ splits into $P_c(4440)$ and $P_c(4457)$
 - $P_c(4380)$ under question
 - Spin-parities are unknown yet
- Theoretical Interpretations of 3 Narrow Pentaquarks:
Molecular, Hadrocharmonium & Compact Multiquark Pictures

Doubly-Heavy Triquark — Light Diquark Model

- Heavy diquark couples with c -antiquark in the color-triplet doubly-heavy triquark (DHT)
- Light diquark being a color antitriplet makes pentaquark colorless
- DHT is practically static
- Light diquark is “rotating” around triquark
- Light diquark is easier to excite orbitally than constituents inside the DHT



Mass Predictions for Unflavored Pentaquarks

J^P	AAAPR	AAAR	J^P	AAAPR	AAAR
	$S_{ld} = 0, L = 0$			$S_{ld} = 1, L = 1$	
$1/2^-$	3830 \pm 34	4086 \pm 42	$1/2^+$	4144 \pm 37	3970 \pm 50
	4150 \pm 29	4162 \pm 38		4209 \pm 37	4174 \pm 44
$3/2^-$	4240 \pm 29	4133 \pm 55		4465 \pm 32	4198 \pm 50
				4530 \pm 32	4221 \pm 40
$1/2^-$	$S_{ld} = 1, L = 0$			4564 \pm 33	4240 \pm 50
	4026 \pm 31	4119 \pm 42		4663 \pm 32	4319 \pm 43
	4346 \pm 25	4166 \pm 38	$3/2^+$	4187 \pm 37	
4436 \pm 25	4264 \pm 41	4250 \pm 37			
$3/2^-$	4026 \pm 31	4072 \pm 40		4508 \pm 32	
	4346 \pm 25	4300 \pm 40		4570 \pm 32	
	4436 \pm 25	4342 \pm 40		4511 \pm 33	
$5/2^-$	4436 \pm 25	4409 \pm 40		4566 \pm 32	
				4656 \pm 32	
$1/2^+$	$S_{ld} = 0, L = 1$		$5/2^+$	4260 \pm 37	4450 \pm 44
	4030 \pm 39	4030 \pm 62		4581 \pm 32	4524 \pm 41
	4351 \pm 35	4141 \pm 44	4601 \pm 32	4678 \pm 44	
$3/2^+$	4430 \pm 35	4217 \pm 40		4656 \pm 32	4720 \pm 44
	4040 \pm 39		$7/2^+$	4672 \pm 32	
	4361 \pm 35				
	4440 \pm 35				
$5/2^+$	4457 \pm 35	4510 \pm 57			