含径向/轨道激发全重四夸克态质量谱

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第七届XYZ粒子研讨会（青岛）

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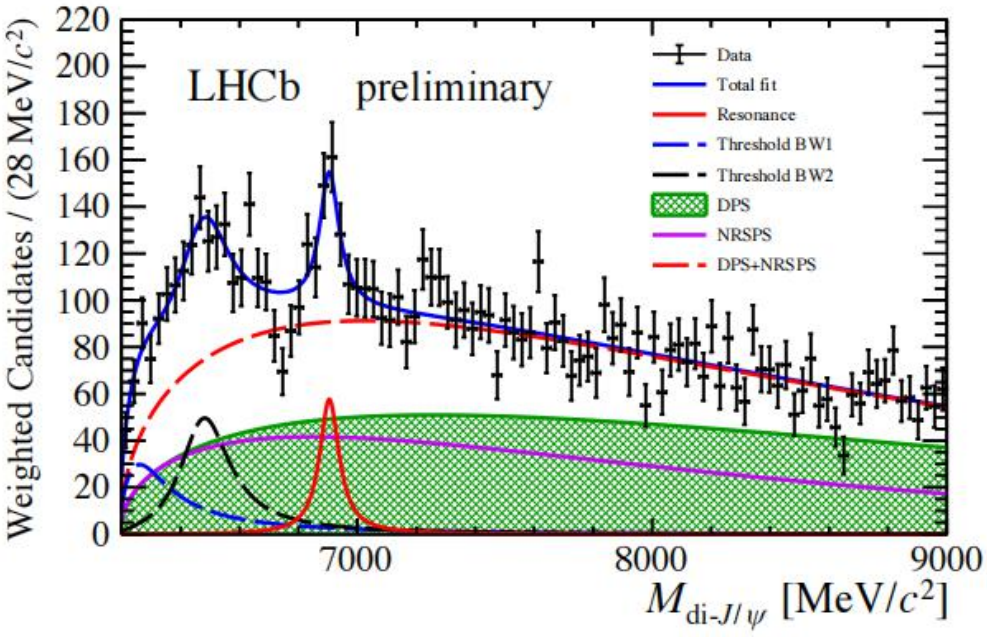
研究背景

第七届XYZ粒子研讨会（青岛）

研究背景

LHCb Collaboration, Science Bulletin 65 (2020) 1983–1993



工作：

M. S. Liu, F. X. Liu, X. H. Zhong, Q. Zhao, arXiv: 2006.11952

F. X. Liu, M. S. Liu, X. H. Zhong, Q. Zhao, Phys. Rev. D 103, 016016

夸克模型与波函数分类

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夸克模型

哈密顿量： $H = T + \sum_{i<j}\left(V_{ij}^{Conf} + V_{ij}^{Coul}\right) + \sum_{i<j}\left(V_{ij}^{SS} + V_{ij}^{LS} + V_{ij}^{Ten}\right)$

参数：

m_c (GeV)	1.483
m_b (GeV)	4.852
α_{cc}	0.5461
α_{bb}	0.4311
σ_{cc} (GeV)	1.1384
σ_{bb} (GeV)	2.3200
b (GeV ^{2})	0.1425

W. J. Deng, H. Liu, L. C. Gui and X. H. Zhong, Phys. Rev. D 95, 034026.

Q. Li, M. S. Liu, L. S. Lu, Q. F. L, L. C. Gui, and X. H.Zhong, Phys. Rev. D 99, 096020.

波函数分类：

味道空间：

对　称　$\{\{qq\}\ \{\bar{q}\bar{q}\}\}$

颜色空间：

对　称　$|6\bar{6}\rangle^c : \left\{\{qq\}^6\ \{\bar{q}\bar{q}\}^{\bar{6}}\right\}$

反对称　$|\bar{3}3\rangle^c : \left\{\{qq\}^{\bar{3}}\ \{\bar{q}\bar{q}\}^3\right\}$

自旋空间：(S-S耦合)

$qq\,(\bar{q}\bar{q})$对称s=1，反对称s=0。

$\{\{qq\}_{s=0}\ \{\bar{q}\bar{q}\}_{s=0}\}_{S=0}$

$\{\{qq\}_{s=0}\ \{\bar{q}\bar{q}\}_{s=1}\}_{S=1}$

$\{\{qq\}_{s=1}\ \{\bar{q}\bar{q}\}_{s=0}\}_{S=1}$

$\{\{qq\}_{s=1}\ \{\bar{q}\bar{q}\}_{s=1}\}_{S=0,1,2}$

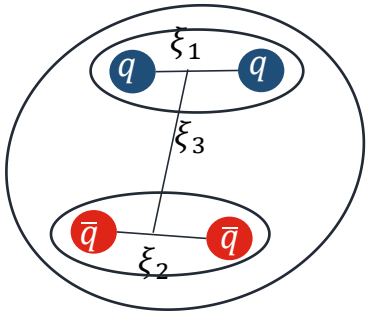
波函数分类：

自旋空间：

$$
\begin{array}{lll}
1 & \chi_{00}^{00} = & \frac{1}{2}(\downarrow\uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow\downarrow - \uparrow\downarrow\downarrow\uparrow + \uparrow\downarrow\uparrow\downarrow) \\
2 & \chi_{11}^{10} = & \frac{1}{\sqrt{2}}(-\uparrow\uparrow\downarrow\uparrow + \uparrow\uparrow\uparrow\downarrow) \\
3 & \chi_{10}^{10} = & \frac{1}{2}(-\downarrow\uparrow\downarrow\uparrow + \downarrow\uparrow\uparrow\downarrow - \uparrow\downarrow\downarrow\uparrow + \uparrow\downarrow\uparrow\downarrow) \\
4 & \chi_{1-1}^{10} = & \frac{1}{\sqrt{2}}(\downarrow\downarrow\uparrow\downarrow - \downarrow\downarrow\downarrow\uparrow) \\
5 & \chi_{11}^{01} = & \frac{1}{\sqrt{2}}(\uparrow\downarrow\uparrow\uparrow - \downarrow\uparrow\uparrow\uparrow) \\
6 & \chi_{10}^{01} = & \frac{1}{2}(\uparrow\downarrow\uparrow\downarrow - \downarrow\uparrow\uparrow\downarrow + \uparrow\downarrow\downarrow\uparrow - \downarrow\uparrow\downarrow\uparrow) \\
7 & \chi_{1-1}^{01} = & \frac{1}{\sqrt{2}}(\uparrow\downarrow\downarrow\downarrow - \downarrow\uparrow\downarrow\downarrow) \\
8 & \chi_{00}^{11} = & \frac{1}{\sqrt{12}}(2\uparrow\uparrow\downarrow\downarrow - \uparrow\downarrow\uparrow\downarrow - \downarrow\uparrow\uparrow\downarrow - \uparrow\downarrow\downarrow\uparrow - \downarrow\uparrow\downarrow\uparrow + 2\downarrow\downarrow\uparrow\uparrow) \\
9 & \chi_{11}^{11} = & \frac{1}{2}(\uparrow\uparrow\uparrow\downarrow + \uparrow\uparrow\downarrow\uparrow - \uparrow\downarrow\uparrow\uparrow - \downarrow\uparrow\uparrow\uparrow) \\
10 & \chi_{10}^{11} = & \frac{1}{\sqrt{2}}(\uparrow\uparrow\downarrow\downarrow - \downarrow\downarrow\uparrow\uparrow) \\
11 & \chi_{1-1}^{11} = & \frac{1}{2}(\uparrow\downarrow\downarrow\downarrow + \downarrow\uparrow\downarrow\downarrow - \downarrow\downarrow\uparrow\downarrow - \downarrow\downarrow\downarrow\uparrow) \\
12 & \chi_{22}^{11} = & \uparrow\uparrow\uparrow\uparrow \\
13 & \chi_{21}^{11} = & \frac{1}{2}(\uparrow\uparrow\uparrow\downarrow + \uparrow\uparrow\downarrow\uparrow + \uparrow\downarrow\uparrow\uparrow + \downarrow\uparrow\uparrow\uparrow) \\
14 & \chi_{20}^{11} = & \frac{1}{\sqrt{6}}(\uparrow\uparrow\downarrow\downarrow + \uparrow\downarrow\uparrow\downarrow + \downarrow\uparrow\uparrow\downarrow + \uparrow\downarrow\downarrow\uparrow + \downarrow\uparrow\downarrow\uparrow + \downarrow\downarrow\uparrow\uparrow) \\
15 & \chi_{2-1}^{11} = & \frac{1}{2}(\uparrow\downarrow\downarrow\downarrow + \downarrow\uparrow\downarrow\downarrow + \downarrow\downarrow\uparrow\downarrow + \downarrow\downarrow\downarrow\uparrow) \\
16 & \chi_{2-2}^{11} = & \downarrow\downarrow\downarrow\downarrow
\end{array}
$$

波函数分类：

坐标空间：（L-L耦合）



		l_{ξ_1}	l_{ξ_2}	l_{ξ_3}	L
2S		0	0	0	0
1P	ξ_1	1	0	0	1
	ξ_2	0	1	0	1
	ξ_3	0	0	1	1
1D	ξ_1	2	0	0	2
	ξ_2	0	2	0	2
	ξ_3	0	0	2	2
	$\xi_1 \otimes \xi_3$	1	0	1	0,1,2
	$\xi_2 \otimes \xi_3$	0	1	1	0,1,2
	$\xi_1 \otimes \xi_2$	1	1	0	0,1,2

波函数分类：

依据置换对称性、J^{PC}量子数的要求构造总波函数。

4个1S态

0^{++}	J_{00}^{00}	:	$\psi_{000}^{1S}\chi_{00}^{00}$	$\|6\bar{6}\rangle^c$
	J_{00}^{00}	:	$\psi_{000}^{1S}\chi_{00}^{11}$	$\|\bar{3}3\rangle^c$
1^{+-}	J_{11}^{01}	:	$\psi_{000}^{1S}\chi_{11}^{11}$	$\|\bar{3}3\rangle^c$
2^{++}	J_{22}^{02}	:	$\psi_{000}^{1S}\chi_{22}^{11}$	$\|\bar{3}3\rangle^c$

12个2S态

0^{+-}	:	$\sqrt{\frac{1}{2}}\left(\psi_{100}^{\xi_1}-\psi_{100}^{\xi_2}\right)$	χ_{00}^{00}	$\|6\bar{6}\rangle^c$
0^{+-}	:	$\sqrt{\frac{1}{2}}\left(\psi_{100}^{\xi_1}-\psi_{100}^{\xi_2}\right)$	χ_{00}^{11}	$\|\bar{3}3\rangle^c$
0^{++}	:	$\sqrt{\frac{1}{2}}\left(\psi_{100}^{\xi_1}+\psi_{100}^{\xi_2}\right)$	χ_{00}^{00}	$\|6\bar{6}\rangle^c$
0^{++}	:	$\sqrt{\frac{1}{2}}\left(\psi_{100}^{\xi_1}+\psi_{100}^{\xi_2}\right)$	χ_{00}^{11}	$\|\bar{3}3\rangle^c$
0^{++}	:	$\psi_{100}^{\xi_3}$	χ_{00}^{00}	$\|6\bar{6}\rangle^c$
0^{++}	:	$\psi_{100}^{\xi_3}$	χ_{00}^{11}	$\|\bar{3}3\rangle^c$

1^{+-}	:	$\sqrt{\frac{1}{2}}\left(\psi_{100}^{\xi_1}-\psi_{100}^{\xi_2}\right)$	χ_{11}^{11}	$\|\bar{3}3\rangle^c$
1^{+-}	:	$\psi_{100}^{\xi_3}$	χ_{11}^{11}	$\|\bar{3}3\rangle^c$
1^{++}	:	$\sqrt{\frac{1}{2}}\left(\psi_{100}^{\xi_1}+\psi_{100}^{\xi_2}\right)$	χ_{11}^{11}	$\|\bar{3}3\rangle^c$
2^{+-}	:	$\sqrt{\frac{1}{2}}\left(\psi_{100}^{\xi_1}-\psi_{100}^{\xi_2}\right)$	χ_{22}^{11}	$\|\bar{3}3\rangle^c$
2^{++}	:	$\sqrt{\frac{1}{2}}\left(\psi_{100}^{\xi_1}+\psi_{100}^{\xi_2}\right)$	χ_{22}^{11}	$\|\bar{3}3\rangle^c$
2^{++}	:	$\psi_{100}^{\xi_3}$	χ_{22}^{11}	$\|\bar{3}3\rangle^c$

波函数分类：

20个1P态

0^{--}	J^{11}_{00}	:	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1}_{011}\chi^{10}_{1-1}-\psi^{\xi_1}_{010}\chi^{10}_{10}+\psi^{\xi_1}_{01-1}\chi^{10}_{11}-\psi^{\xi_2}_{011}\chi^{01}_{1-1}+\psi^{\xi_2}_{010}\chi^{01}_{10}-\psi^{\xi_2}_{01-1}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
0^{--}	J^{11}_{00}	:	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1}_{011}\chi^{01}_{1-1}-\psi^{\xi_1}_{010}\chi^{01}_{10}+\psi^{\xi_1}_{01-1}\chi^{01}_{11}-\psi^{\xi_2}_{011}\chi^{10}_{1-1}+\psi^{\xi_2}_{010}\chi^{10}_{10}-\psi^{\xi_2}_{01-1}\chi^{10}_{11}\right)$	$\|3\bar{3}\rangle^c$
0^{-+}	J^{11}_{00}	:	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1}_{011}\chi^{10}_{1-1}-\psi^{\xi_1}_{010}\chi^{10}_{10}+\psi^{\xi_1}_{01-1}\chi^{10}_{11}+\psi^{\xi_2}_{011}\chi^{01}_{1-1}-\psi^{\xi_2}_{010}\chi^{01}_{10}+\psi^{\xi_2}_{01-1}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
0^{-+}	J^{11}_{00}	:	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1}_{011}\chi^{01}_{1-1}-\psi^{\xi_1}_{010}\chi^{01}_{10}+\psi^{\xi_1}_{01-1}\chi^{01}_{11}+\psi^{\xi_2}_{011}\chi^{10}_{1-1}-\psi^{\xi_2}_{010}\chi^{10}_{10}+\psi^{\xi_2}_{01-1}\chi^{10}_{11}\right)$	$\|3\bar{3}\rangle^c$
0^{-+}	J^{11}_{00}	:	$\sqrt{\frac{1}{3}}\left(\psi^{\xi_3}_{011}\chi^{11}_{1-1}-\psi^{\xi_3}_{010}\chi^{11}_{10}+\psi^{\xi_3}_{01-1}\chi^{11}_{11}\right)$	$\|3\bar{3}\rangle^c$
1^{--}	J^{11}_{11}	:	$\frac{1}{2}\left(\psi^{\xi_1}_{011}\chi^{10}_{10}-\psi^{\xi_1}_{010}\chi^{10}_{11}-\psi^{\xi_2}_{011}\chi^{01}_{10}+\psi^{\xi_2}_{010}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
1^{--}	J^{11}_{11}	:	$\frac{1}{2}\left(\psi^{\xi_1}_{011}\chi^{01}_{10}-\psi^{\xi_1}_{010}\chi^{01}_{11}-\psi^{\xi_2}_{011}\chi^{10}_{10}+\psi^{\xi_2}_{010}\chi^{10}_{11}\right)$	$\|3\bar{3}\rangle^c$
1^{--}	J^{12}_{11}	:	$\sqrt{\frac{1}{10}}\psi^{\xi_3}_{011}\chi^{11}_{20}-\sqrt{\frac{3}{10}}\psi^{\xi_3}_{010}\chi^{11}_{21}+\sqrt{\frac{3}{5}}\psi^{\xi_3}_{01-1}\chi^{11}_{22}$	$\|3\bar{3}\rangle^c$
1^{--}	J^{10}_{11}	:	$\psi^{\xi_3}_{011}\chi^{00}_{00}$	$\|6\bar{6}\rangle^c$
1^{--}	J^{10}_{11}	:	$\psi^{\xi_3}_{011}\chi^{11}_{00}$	$\|3\bar{3}\rangle^c$
1^{-+}	J^{11}_{11}	:	$\frac{1}{2}\left(\psi^{\xi_1}_{011}\chi^{10}_{10}-\psi^{\xi_1}_{010}\chi^{10}_{11}+\psi^{\xi_2}_{011}\chi^{01}_{10}-\psi^{\xi_2}_{010}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
1^{-+}	J^{11}_{11}	:	$\frac{1}{2}\left(\psi^{\xi_1}_{011}\chi^{01}_{10}-\psi^{\xi_1}_{010}\chi^{01}_{11}+\psi^{\xi_2}_{011}\chi^{10}_{10}-\psi^{\xi_2}_{010}\chi^{10}_{11}\right)$	$\|3\bar{3}\rangle^c$
1^{-+}	J^{11}_{11}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_3}_{011}\chi^{11}_{10}-\psi^{\xi_3}_{010}\chi^{11}_{11}\right)$	$\|3\bar{3}\rangle^c$
2^{--}	J^{11}_{22}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{011}\chi^{10}_{11}-\psi^{\xi_2}_{011}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
2^{--}	J^{11}_{22}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{011}\chi^{01}_{11}-\psi^{\xi_2}_{011}\chi^{10}_{11}\right)$	$\|3\bar{3}\rangle^c$
2^{--}	J^{12}_{22}	:	$\sqrt{\frac{1}{3}}\psi^{\xi_3}_{011}\chi^{11}_{21}-\sqrt{\frac{2}{3}}\psi^{\xi_3}_{010}\chi^{11}_{22}$	$\|3\bar{3}\rangle^c$
2^{-+}	J^{11}_{22}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{011}\chi^{10}_{11}+\psi^{\xi_2}_{011}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
2^{-+}	J^{11}_{22}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{011}\chi^{01}_{11}+\psi^{\xi_2}_{011}\chi^{10}_{11}\right)$	$\|3\bar{3}\rangle^c$
2^{-+}	J^{11}_{22}	:	$\psi^{\xi_3}_{011}\chi^{11}_{11}$	$\|3\bar{3}\rangle^c$
3^{--}	J^{12}_{33}	:	$\psi^{\xi_3}_{011}\chi^{11}_{22}$	$\|3\bar{3}\rangle^c$

波函数分类：

80个1D态

0^{+-}	J^{11}_{00}	:	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{1-1}-\psi^{\xi_1\xi_3}_{010}\chi^{10}_{10}+\psi^{\xi_1\xi_3}_{01-1}\chi^{10}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{01}_{1-1}+\psi^{\xi_2\xi_3}_{010}\chi^{01}_{10}-\psi^{\xi_2\xi_3}_{01-1}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
0^{+-}	J^{11}_{00}	:	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{1-1}-\psi^{\xi_1\xi_3}_{010}\chi^{01}_{10}+\psi^{\xi_1\xi_3}_{01-1}\chi^{01}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{10}_{1-1}+\psi^{\xi_2\xi_3}_{010}\chi^{10}_{10}-\psi^{\xi_2\xi_3}_{01-1}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
0^{+-}	J^{22}_{00}	:	$\sqrt{\frac{1}{10}}\left(\psi^{\xi_1}_{022}\chi^{11}_{2-2}-\psi^{\xi_1}_{021}\chi^{11}_{2-1}+\psi^{\xi_1}_{020}\chi^{11}_{20}-\psi^{\xi_1}_{02-1}\chi^{11}_{21}+\psi^{\xi_1}_{02-2}\chi^{11}_{22}-\psi^{\xi_2}_{022}\chi^{11}_{2-2}+\psi^{\xi_2}_{021}\chi^{11}_{2-1}-\psi^{\xi_2}_{020}\chi^{11}_{20}+\psi^{\xi_2}_{02-1}\chi^{11}_{21}-\psi^{\xi_2}_{02-2}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
0^{++}	J^{00}_{00}	:	$\psi^{\xi_1\xi_2}_{000}\chi^{00}_{00}$	$\|\bar{3}3\rangle^c$
0^{++}	J^{00}_{00}	:	$\psi^{\xi_1\xi_2}_{000}\chi^{11}_{00}$	$\|6\bar{6}\rangle^c$
0^{++}	J^{11}_{00}	:	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{1-1}-\psi^{\xi_1\xi_3}_{010}\chi^{10}_{10}+\psi^{\xi_1\xi_3}_{01-1}\chi^{10}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{01}_{1-1}-\psi^{\xi_2\xi_3}_{010}\chi^{01}_{10}+\psi^{\xi_2\xi_3}_{01-1}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
0^{++}	J^{11}_{00}	:	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{1-1}-\psi^{\xi_1\xi_3}_{010}\chi^{01}_{10}+\psi^{\xi_1\xi_3}_{01-1}\chi^{01}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{10}_{1-1}-\psi^{\xi_2\xi_3}_{010}\chi^{10}_{10}+\psi^{\xi_2\xi_3}_{01-1}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
0^{++}	J^{11}_{00}	:	$\sqrt{\frac{1}{3}}\left(\psi^{\xi_1\xi_2}_{011}\chi^{11}_{1-1}-\psi^{\xi_1\xi_2}_{010}\chi^{11}_{10}+\psi^{\xi_1\xi_2}_{01-1}\chi^{11}_{11}\right)$	$\|6\bar{6}\rangle^c$
0^{++}	J^{22}_{00}	:	$\sqrt{\frac{1}{10}}\left(\psi^{\xi_1}_{022}\chi^{11}_{2-2}-\psi^{\xi_1}_{021}\chi^{11}_{2-1}+\psi^{\xi_1}_{020}\chi^{11}_{20}-\psi^{\xi_1}_{02-1}\chi^{11}_{21}+\psi^{\xi_1}_{02-2}\chi^{11}_{22}+\psi^{\xi_2}_{022}\chi^{11}_{2-2}-\psi^{\xi_2}_{021}\chi^{11}_{2-1}+\psi^{\xi_2}_{020}\chi^{11}_{20}-\psi^{\xi_2}_{02-1}\chi^{11}_{21}+\psi^{\xi_2}_{02-2}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
0^{++}	J^{22}_{00}	:	$\sqrt{\frac{1}{5}}\left(\psi^{\xi_3}_{022}\chi^{11}_{2-2}-\psi^{\xi_3}_{021}\chi^{11}_{2-1}+\psi^{\xi_3}_{020}\chi^{11}_{20}-\psi^{\xi_3}_{02-1}\chi^{11}_{21}+\psi^{\xi_3}_{02-2}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
0^{++}	J^{22}_{00}	:	$\sqrt{\frac{1}{5}}\left(\psi^{\xi_1\xi_2}_{022}\chi^{11}_{2-2}-\psi^{\xi_1\xi_2}_{021}\chi^{11}_{2-1}+\psi^{\xi_1\xi_2}_{020}\chi^{11}_{20}-\psi^{\xi_1\xi_2}_{02-1}\chi^{11}_{21}+\psi^{\xi_1\xi_2}_{02-2}\chi^{11}_{22}\right)$	$\|6\bar{6}\rangle^c$
1^{+-}	J^{01}_{11}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{000}\chi^{10}_{11}-\psi^{\xi_2\xi_3}_{000}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
1^{+-}	J^{01}_{11}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{000}\chi^{01}_{11}-\psi^{\xi_2\xi_3}_{000}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
1^{+-}	J^{01}_{11}	:	$\psi^{\xi_1\xi_2}_{000}\chi^{11}_{11}$	$\|6\bar{6}\rangle^c$
1^{+-}	J^{10}_{11}	:	$\psi^{\xi_1\xi_2}_{011}\chi^{00}_{00}$	$\|\bar{3}3\rangle^c$
1^{+-}	J^{10}_{11}	:	$\psi^{\xi_1\xi_2}_{011}\chi^{11}_{00}$	$\|6\bar{6}\rangle^c$
1^{+-}	J^{11}_{11}	:	$\frac{1}{2}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{10}-\psi^{\xi_1\xi_3}_{010}\chi^{10}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{01}_{10}+\psi^{\xi_2\xi_3}_{010}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
1^{+-}	J^{11}_{11}	:	$\frac{1}{2}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{10}-\psi^{\xi_1\xi_3}_{010}\chi^{01}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{10}_{10}+\psi^{\xi_2\xi_3}_{010}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
1^{+-}	J^{12}_{11}	:	$\sqrt{\frac{1}{10}}\psi^{\xi_1\xi_2}_{011}\chi^{11}_{20}-\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_2}_{010}\chi^{11}_{21}+\sqrt{\frac{3}{5}}\psi^{\xi_1\xi_2}_{01-1}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$
1^{+-}	J^{21}_{11}	:	$\sqrt{\frac{3}{10}}\psi^{\xi_1}_{022}\chi^{11}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1}_{021}\chi^{11}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1}_{020}\chi^{11}_{11}-\sqrt{\frac{3}{10}}\psi^{\xi_2}_{022}\chi^{11}_{1-1}+\sqrt{\frac{3}{20}}\psi^{\xi_2}_{021}\chi^{11}_{10}-\sqrt{\frac{1}{20}}\psi^{\xi_2}_{020}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
1^{+-}	J^{21}_{11}	:	$\sqrt{\frac{3}{5}}\psi^{\xi_3}_{022}\chi^{11}_{1-1}-\sqrt{\frac{3}{10}}\psi^{\xi_3}_{021}\chi^{11}_{10}+\sqrt{\frac{1}{10}}\psi^{\xi_3}_{020}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
1^{+-}	J^{21}_{11}	:	$\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_3}_{022}\chi^{10}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1\xi_3}_{021}\chi^{10}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1\xi_3}_{020}\chi^{10}_{11}-\sqrt{\frac{3}{10}}\psi^{\xi_2\xi_3}_{022}\chi^{01}_{1-1}+\sqrt{\frac{3}{20}}\psi^{\xi_2\xi_3}_{021}\chi^{01}_{10}-\sqrt{\frac{1}{20}}\psi^{\xi_2\xi_3}_{020}\chi^{01}_{11}$	$\|6\bar{6}\rangle^c$
1^{+-}	J^{21}_{11}	:	$\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_3}_{022}\chi^{01}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1\xi_3}_{021}\chi^{01}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1\xi_3}_{020}\chi^{01}_{11}-\sqrt{\frac{3}{10}}\psi^{\xi_2\xi_3}_{022}\chi^{10}_{1-1}+\sqrt{\frac{3}{20}}\psi^{\xi_2\xi_3}_{021}\chi^{10}_{10}-\sqrt{\frac{1}{20}}\psi^{\xi_2\xi_3}_{020}\chi^{10}_{11}$	$\|\bar{3}3\rangle^c$
1^{+-}	J^{21}_{11}	:	$\sqrt{\frac{3}{5}}\psi^{\xi_1\xi_2}_{022}\chi^{11}_{1-1}-\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_2}_{021}\chi^{11}_{10}+\sqrt{\frac{1}{10}}\psi^{\xi_1\xi_2}_{020}\chi^{11}_{11}$	$\|6\bar{6}\rangle^c$
1^{+-}	J^{22}_{11}	:	$\sqrt{\frac{1}{10}}\psi^{\xi_1}_{022}\chi^{11}_{2-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1}_{021}\chi^{11}_{20}+\sqrt{\frac{3}{20}}\psi^{\xi_1}_{020}\chi^{11}_{21}-\sqrt{\frac{1}{10}}\psi^{\xi_1}_{02-1}\chi^{11}_{22}-\sqrt{\frac{1}{10}}\psi^{\xi_2}_{022}\chi^{11}_{2-1}+\sqrt{\frac{3}{20}}\psi^{\xi_2}_{021}\chi^{11}_{20}-\sqrt{\frac{3}{20}}\psi^{\xi_2}_{020}\chi^{11}_{21}+\sqrt{\frac{1}{10}}\psi^{\xi_2}_{02-1}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$

波函数分类：

$$
\begin{array}{llll}
1^{++} & J^{01}_{11} & : & \sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{000}\chi^{10}_{11}+\psi^{\xi_2\xi_3}_{000}\chi^{01}_{11}\right) \quad |6\bar{6}\rangle^c \\
1^{++} & J^{01}_{11} & : & \sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{000}\chi^{01}_{11}+\psi^{\xi_2\xi_3}_{000}\chi^{10}_{11}\right) \quad |\bar{3}3\rangle^c \\
1^{++} & J^{11}_{11} & : & \frac{1}{2}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{10}-\psi^{\xi_1\xi_3}_{010}\chi^{10}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{01}_{10}-\psi^{\xi_2\xi_3}_{010}\chi^{01}_{11}\right) \quad |6\bar{6}\rangle^c \\
1^{++} & J^{11}_{11} & : & \frac{1}{2}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{10}-\psi^{\xi_1\xi_3}_{010}\chi^{01}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{10}_{10}-\psi^{\xi_2\xi_3}_{010}\chi^{10}_{11}\right) \quad |\bar{3}3\rangle^c \\
1^{++} & J^{11}_{11} & : & \sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_2}_{011}\chi^{11}_{10}-\psi^{\xi_1\xi_2}_{010}\chi^{11}_{11}\right) \quad |6\bar{6}\rangle^c \\
1^{++} & J^{21}_{11} & : & \sqrt{\frac{3}{10}}\psi^{\xi_1}_{022}\chi^{11}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1}_{021}\chi^{11}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1}_{020}\chi^{11}_{11}+\sqrt{\frac{3}{10}}\psi^{\xi_2}_{022}\chi^{11}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_2}_{021}\chi^{11}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_2}_{020}\chi^{11}_{11} \quad |\bar{3}3\rangle^c \\
1^{++} & J^{21}_{11} & : & \sqrt{\frac{3}{10}}\psi^{\xi_1\xi_3}_{022}\chi^{10}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1\xi_3}_{021}\chi^{10}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1\xi_3}_{020}\chi^{10}_{11}+\sqrt{\frac{3}{10}}\psi^{\xi_2\xi_3}_{022}\chi^{01}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_2\xi_3}_{021}\chi^{01}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_2\xi_3}_{020}\chi^{01}_{11} \quad |6\bar{6}\rangle^c \\
1^{++} & J^{21}_{11} & : & \sqrt{\frac{3}{10}}\psi^{\xi_1\xi_3}_{022}\chi^{01}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1\xi_3}_{021}\chi^{01}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1\xi_3}_{020}\chi^{01}_{11}+\sqrt{\frac{3}{10}}\psi^{\xi_2\xi_3}_{022}\chi^{10}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_2\xi_3}_{021}\chi^{10}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_2\xi_3}_{020}\chi^{10}_{11} \quad |\bar{3}3\rangle^c \\
1^{++} & J^{22}_{11} & : & \sqrt{\frac{1}{10}}\psi^{\xi_1}_{022}\chi^{11}_{2-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1}_{021}\chi^{11}_{20}+\sqrt{\frac{3}{20}}\psi^{\xi_1}_{020}\chi^{11}_{21}-\sqrt{\frac{1}{10}}\psi^{\xi_1}_{02-1}\chi^{11}_{22}+\sqrt{\frac{1}{10}}\psi^{\xi_2}_{022}\chi^{11}_{2-1}-\sqrt{\frac{3}{20}}\psi^{\xi_2}_{021}\chi^{11}_{20}+\sqrt{\frac{3}{20}}\psi^{\xi_2}_{020}\chi^{11}_{21}-\sqrt{\frac{1}{10}}\psi^{\xi_2}_{02-1}\chi^{11}_{22} \quad |\bar{3}3\rangle^c \\
1^{++} & J^{22}_{11} & : & \sqrt{\frac{1}{5}}\psi^{\xi_3}_{022}\chi^{11}_{2-1}-\sqrt{\frac{3}{10}}\psi^{\xi_3}_{021}\chi^{11}_{20}+\sqrt{\frac{3}{10}}\psi^{\xi_3}_{020}\chi^{11}_{21}-\sqrt{\frac{1}{5}}\psi^{\xi_3}_{02-1}\chi^{11}_{22} \quad |\bar{3}3\rangle^c \\
1^{++} & J^{22}_{11} & : & \sqrt{\frac{1}{5}}\psi^{\xi_1\xi_2}_{022}\chi^{11}_{2-1}-\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_2}_{021}\chi^{11}_{20}+\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_2}_{020}\chi^{11}_{21}-\sqrt{\frac{1}{5}}\psi^{\xi_1\xi_2}_{02-1}\chi^{11}_{22} \quad |6\bar{6}\rangle^c \\
\hline
2^{+-} & J^{11}_{22} & : & \sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{01}_{11}\right) \quad |6\bar{6}\rangle^c \\
2^{+-} & J^{11}_{22} & : & \sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{10}_{11}\right) \quad |\bar{3}3\rangle^c \\
2^{+-} & J^{12}_{22} & : & \sqrt{\frac{1}{3}}\psi^{\xi_1\xi_2}_{011}\chi^{11}_{21}-\sqrt{\frac{2}{3}}\psi^{\xi_1\xi_2}_{010}\chi^{11}_{22} \quad |6\bar{6}\rangle^c \\
2^{+-} & J^{20}_{22} & : & \sqrt{\frac{1}{2}}\psi^{\xi_1}_{022}\chi^{00}_{00}-\sqrt{\frac{1}{2}}\psi^{\xi_2}_{022}\chi^{00}_{00} \quad |6\bar{6}\rangle^c \\
2^{+-} & J^{20}_{22} & : & \sqrt{\frac{1}{2}}\psi^{\xi_1}_{022}\chi^{11}_{00}-\sqrt{\frac{1}{2}}\psi^{\xi_2}_{022}\chi^{11}_{00} \quad |\bar{3}3\rangle^c \\
2^{+-} & J^{21}_{22} & : & \sqrt{\frac{2}{6}}\psi^{\xi_1}_{022}\chi^{11}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1}_{021}\chi^{11}_{11}-\sqrt{\frac{2}{6}}\psi^{\xi_2}_{022}\chi^{11}_{10}+\sqrt{\frac{1}{6}}\psi^{\xi_2}_{021}\chi^{11}_{11} \quad |\bar{3}3\rangle^c \\
2^{+-} & J^{21}_{22} & : & \sqrt{\frac{2}{3}}\psi^{\xi_3}_{022}\chi^{11}_{10}-\sqrt{\frac{1}{3}}\psi^{\xi_3}_{021}\chi^{11}_{11} \quad |\bar{3}3\rangle^c \\
2^{+-} & J^{21}_{22} & : & \sqrt{\frac{2}{6}}\psi^{\xi_1\xi_3}_{022}\chi^{10}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1\xi_3}_{021}\chi^{10}_{11}-\sqrt{\frac{2}{6}}\psi^{\xi_2\xi_3}_{022}\chi^{01}_{10}+\sqrt{\frac{1}{6}}\psi^{\xi_2\xi_3}_{021}\chi^{01}_{11} \quad |6\bar{6}\rangle^c \\
2^{+-} & J^{21}_{22} & : & \sqrt{\frac{2}{6}}\psi^{\xi_1\xi_3}_{022}\chi^{01}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1\xi_3}_{021}\chi^{01}_{11}-\sqrt{\frac{2}{6}}\psi^{\xi_2\xi_3}_{022}\chi^{10}_{10}+\sqrt{\frac{1}{6}}\psi^{\xi_2\xi_3}_{021}\chi^{10}_{11} \quad |\bar{3}3\rangle^c \\
2^{+-} & J^{21}_{22} & : & \sqrt{\frac{2}{3}}\psi^{\xi_1\xi_2}_{022}\chi^{11}_{10}-\sqrt{\frac{1}{3}}\psi^{\xi_1\xi_2}_{021}\chi^{11}_{11} \quad |6\bar{6}\rangle^c \\
2^{+-} & J^{22}_{22} & : & \sqrt{\frac{2}{14}}\psi^{\xi_1}_{022}\chi^{11}_{20}-\sqrt{\frac{3}{14}}\psi^{\xi_1}_{021}\chi^{11}_{21}+\sqrt{\frac{2}{14}}\psi^{\xi_1}_{020}\chi^{11}_{22}-\sqrt{\frac{2}{14}}\psi^{\xi_2}_{022}\chi^{11}_{20}+\sqrt{\frac{3}{14}}\psi^{\xi_2}_{021}\chi^{11}_{21}-\sqrt{\frac{2}{14}}\psi^{\xi_2}_{020}\chi^{11}_{22} \quad |\bar{3}3\rangle^c \\
\hline
2^{++} & J^{02}_{22} & : & \psi^{\xi_1\xi_2}_{000}\chi^{11}_{22} \quad |6\bar{6}\rangle^c \\
2^{++} & J^{11}_{22} & : & \sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{01}_{11}\right) \quad |6\bar{6}\rangle^c \\
2^{++} & J^{11}_{22} & : & \sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{10}_{11}\right) \quad |\bar{3}3\rangle^c \\
2^{++} & J^{11}_{22} & : & \psi^{\xi_1\xi_2}_{011}\chi^{11}_{11} \quad |6\bar{6}\rangle^c \\
2^{++} & J^{20}_{22} & : & \sqrt{\frac{1}{2}}\psi^{\xi_1}_{022}\chi^{00}_{00}+\sqrt{\frac{1}{2}}\psi^{\xi_2}_{022}\chi^{00}_{00} \quad |6\bar{6}\rangle^c
\end{array}
$$

波函数分类：

2^{++}	J^{20}_{22}	:	$\sqrt{\frac{1}{2}}\psi^{\xi_1}_{022}\chi^{11}_{00}+\sqrt{\frac{1}{2}}\psi^{\xi_2}_{022}\chi^{11}_{00}$	$\|\bar{3}3\rangle^c$
2^{++}	J^{20}_{22}	:	$\psi^{\xi_3}_{022}\chi^{00}_{00}$	$\|6\bar{6}\rangle^c$
2^{++}	J^{20}_{22}	:	$\psi^{\xi_3}_{022}\chi^{11}_{00}$	$\|\bar{3}3\rangle^c$
2^{++}	J^{20}_{22}	:	$\psi^{\xi_1\xi_2}_{022}\chi^{00}_{00}$	$\|\bar{3}3\rangle^c$
2^{++}	J^{20}_{22}	:	$\psi^{\xi_1\xi_2}_{022}\chi^{11}_{00}$	$\|6\bar{6}\rangle^c$
2^{++}	J^{21}_{22}	:	$\sqrt{\frac{2}{6}}\psi^{\xi_1}_{022}\chi^{11}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1}_{021}\chi^{11}_{11}+\sqrt{\frac{2}{6}}\psi^{\xi_2}_{022}\chi^{11}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_2}_{021}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
2^{++}	J^{21}_{22}	:	$\sqrt{\frac{2}{6}}\psi^{\xi_1\xi_3}_{022}\chi^{10}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1\xi_3}_{021}\chi^{10}_{11}+\sqrt{\frac{2}{6}}\psi^{\xi_2\xi_3}_{022}\chi^{01}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_2\xi_3}_{021}\chi^{01}_{11}$	$\|6\bar{6}\rangle^c$
2^{++}	J^{21}_{22}	:	$\sqrt{\frac{2}{6}}\psi^{\xi_1\xi_3}_{022}\chi^{01}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1\xi_3}_{021}\chi^{01}_{11}+\sqrt{\frac{2}{6}}\psi^{\xi_2\xi_3}_{022}\chi^{10}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_2\xi_3}_{021}\chi^{10}_{11}$	$\|\bar{3}3\rangle^c$
2^{++}	J^{22}_{22}	:	$\sqrt{\frac{2}{14}}\psi^{\xi_1}_{022}\chi^{11}_{20}-\sqrt{\frac{3}{14}}\psi^{\xi_1}_{021}\chi^{11}_{21}+\sqrt{\frac{2}{14}}\psi^{\xi_1}_{020}\chi^{11}_{22}+\sqrt{\frac{2}{14}}\psi^{\xi_2}_{022}\chi^{11}_{20}-\sqrt{\frac{3}{14}}\psi^{\xi_2}_{021}\chi^{11}_{21}+\sqrt{\frac{2}{14}}\psi^{\xi_2}_{020}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
2^{++}	J^{22}_{22}	:	$\sqrt{\frac{2}{7}}\psi^{\xi_3}_{022}\chi^{11}_{20}-\sqrt{\frac{3}{7}}\psi^{\xi_3}_{021}\chi^{11}_{21}+\sqrt{\frac{2}{7}}\psi^{\xi_3}_{020}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
2^{++}	J^{22}_{22}	:	$\sqrt{\frac{2}{7}}\psi^{\xi_1\xi_2}_{022}\chi^{11}_{20}-\sqrt{\frac{3}{7}}\psi^{\xi_1\xi_2}_{021}\chi^{11}_{21}+\sqrt{\frac{2}{7}}\psi^{\xi_1\xi_2}_{020}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$
3^{+-}	J^{12}_{33}	:	$\psi^{\xi_1\xi_2}_{011}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$
3^{+-}	J^{21}_{33}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{022}\chi^{11}_{11}-\psi^{\xi_2}_{022}\chi^{11}_{11}\right)$	$\|\bar{3}3\rangle^c$
3^{+-}	J^{21}_{33}	:	$\psi^{\xi_3}_{022}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
3^{+-}	J^{21}_{33}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{022}\chi^{10}_{11}-\psi^{\xi_2\xi_3}_{022}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
3^{+-}	J^{21}_{33}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{022}\chi^{01}_{11}-\psi^{\xi_2\xi_3}_{022}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
3^{+-}	J^{21}_{33}	:	$\psi^{\xi_1\xi_2}_{022}\chi^{11}_{11}$	$\|6\bar{6}\rangle^c$
3^{+-}	J^{22}_{33}	:	$\frac{1}{2}\left(\psi^{\xi_1}_{022}\chi^{11}_{21}-\psi^{\xi_1}_{021}\chi^{11}_{22}-\psi^{\xi_2}_{022}\chi^{11}_{21}+\psi^{\xi_2}_{021}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
3^{++}	J^{21}_{33}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{022}\chi^{11}_{11}+\psi^{\xi_2}_{022}\chi^{11}_{11}\right)$	$\|\bar{3}3\rangle^c$
3^{++}	J^{21}_{33}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{022}\chi^{10}_{11}+\psi^{\xi_2\xi_3}_{022}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
3^{++}	J^{21}_{33}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{022}\chi^{01}_{11}+\psi^{\xi_2\xi_3}_{022}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
3^{++}	J^{22}_{33}	:	$\frac{1}{2}\left(\psi^{\xi_1}_{022}\chi^{11}_{21}-\psi^{\xi_1}_{021}\chi^{11}_{22}+\psi^{\xi_2}_{022}\chi^{11}_{21}-\psi^{\xi_2}_{021}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
3^{++}	J^{22}_{33}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_3}_{022}\chi^{11}_{21}-\psi^{\xi_3}_{021}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
3^{++}	J^{22}_{33}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_2}_{022}\chi^{11}_{21}-\psi^{\xi_1\xi_2}_{021}\chi^{11}_{22}\right)$	$\|6\bar{6}\rangle^c$
4^{+-}	J^{22}_{44}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{022}\chi^{11}_{22}-\psi^{\xi_2}_{022}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
4^{++}	J^{22}_{44}	:	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{022}\chi^{11}_{22}+\psi^{\xi_2}_{022}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
4^{++}	J^{22}_{44}	:	$\psi^{\xi_3}_{022}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
4^{++}	J^{22}_{44}	:	$\psi^{\xi_1\xi_2}_{022}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$

计算方法

第七届XYZ粒子研讨会（青岛）

计算方法

计算质量矩阵元

$$\langle\psi^n|H|\psi^m\rangle=E_m\langle\psi^n|\psi^m\rangle$$

$$
\begin{aligned}
&\langle\bar{\psi}^n|H|\bar{\psi}^m\rangle \\
=&\quad\left(\sum_{i=1}^{4} m_i\right)\quad\langle\varphi^{c_n}|\varphi^{c_m}\rangle\quad\langle\psi^n\chi^n|\psi^m\chi^m\rangle\quad\langle\phi^f|\phi^f\rangle \\
+&\quad\langle\varphi^{c_n}|\varphi^{c_m}\rangle\quad\langle\psi^n\chi^n|\left(\sum_{i=1}^{4} T_i\right)-T_G|\psi^m\chi^m\rangle\quad\langle\phi^f|\phi^f\rangle \\
-&\sum_{i<j}\ \frac{3}{16}\cdot b_{ij}\quad\langle\varphi^{c_n}|\boldsymbol{\lambda}_i\cdot\boldsymbol{\lambda}_j|\varphi^{c_m}\rangle\quad\langle\psi^n\chi^n|r_{ij}|\psi^m\chi^m\rangle\quad\langle\phi^f|\phi^f\rangle \\
+&\sum_{i<j}\ \frac{\alpha_{ij}^{Coul}}{4}\quad\langle\varphi^{c_n}|\boldsymbol{\lambda}_i\cdot\boldsymbol{\lambda}_j|\varphi^{c_m}\rangle\quad\langle\psi^n\chi^n|\frac{1}{r_{ij}}|\psi^m\chi^m\rangle\quad\langle\phi^f|\phi^f\rangle \\
-&\sum_{i<j}\ \frac{2\pi\alpha_{ij}^{SS}}{3m_im_j}\quad\langle\varphi^{c_n}|\boldsymbol{\lambda}_i\cdot\boldsymbol{\lambda}_j|\varphi^{c_m}\rangle\quad\langle\psi^n\chi^n|\frac{\sigma_{ij}^3e^{-\sigma_{ij}^2r_{ij}^2}}{\pi^{\frac{3}{2}}}\cdot(\boldsymbol{s}_i\cdot\boldsymbol{s}_j)|\psi^m\chi^m\rangle\quad\langle\phi^f|\phi^f\rangle \\
-&\sum_{i<j}\ \frac{\alpha_{ij}^{ten}}{4m_im_j}\quad\langle\varphi^{c_n}|\boldsymbol{\lambda}_i\cdot\boldsymbol{\lambda}_j|\varphi^{c_m}\rangle\quad\langle\psi^n\chi^n|\frac{1}{r_{ij}^3}\cdot\left[\frac{3(\boldsymbol{s}_i\cdot\boldsymbol{r}_{ij})(\boldsymbol{s}_j\cdot\boldsymbol{r}_{ij})}{r_{ij}^2}-(\boldsymbol{s}_i\cdot\boldsymbol{s}_j)\right]|\psi^m\chi^m\rangle\quad\langle\phi^f|\phi^f\rangle \\
-&\sum_{i<j}\ \frac{\alpha_{ij}^{SO}}{16}\quad\langle\varphi^{c_n}|\boldsymbol{\lambda}_i\cdot\boldsymbol{\lambda}_j|\varphi^{c_m}\rangle\quad\langle\psi^n\chi^n|\frac{1}{r_{ij}^3}\cdot\left[\left(\frac{1}{m_i^2}+\frac{1}{m_j^2}+4\frac{1}{m_im_j}\right)\cdot\boldsymbol{l}_{ij}\cdot(\boldsymbol{s}_i+\boldsymbol{s}_j)\right]|\psi^m\chi^m\rangle\quad\langle\phi^f|\phi^f\rangle \\
-&\sum\ \frac{3}{16}\cdot c_{ij}\quad\langle\varphi^{c_n}|\boldsymbol{\lambda}_i\cdot\boldsymbol{\lambda}_j|\varphi^{c_m}\rangle\quad\langle\psi^n\chi^n|\psi^m\chi^m\rangle\quad\langle\phi^f|\phi^f\rangle
\end{aligned}
$$

计算方法

试探波函数用一组高斯基展开：

$$\prod_{i=1}^{3} R_{n_{\xi_i} l_{\xi_i}}(\xi_i) = \sum_{\ell}^{n}\sum_{\ell'}^{n}\sum_{\ell''}^{n} C_{\xi_1\ell} C_{\xi_2\ell'} C_{\xi_3\ell''} \phi_{n_{\xi_1} l_{\xi_1}}(\omega_{\xi_1\ell}, \xi_1)\phi_{n_{\xi_2} l_{\xi_2}}(\omega_{\xi_2\ell'}, \xi_2)\phi_{n_{\xi_3} l_{\xi_3}}(\omega_{\xi_3\ell''}, \xi_3)\delta_{\ell\ell'}\delta_{\ell\ell''}$$

$$= \sum_{\ell}^{n} C_{\ell}\phi_{n_{\xi_1} l_{\xi_1}}(\omega_{\ell}, \xi_1)\phi_{n_{\xi_2} l_{\xi_2}}(\omega_{\ell}, \xi_2)\phi_{n_{\xi_3} l_{\xi_3}}(\omega_{\ell}, \xi_3).$$

$$\phi_{n_\xi l_\xi}(d_{\xi\ell}, \xi) = \left(\frac{1}{d_{\xi\ell}}\right)^{\frac{3}{2}} \left[\frac{2^{l_\xi+2-n_\xi}(2l_\xi+2n_\xi+1)!!}{\sqrt{\pi} n_\xi! \left[(2l_\xi+1)!!\right]^2}\right]^{\frac{1}{2}} \left(\frac{\xi}{d_{\xi\ell}}\right)^{l_\xi} \times e^{-\frac{1}{2}\left(\frac{\xi}{d_{\xi\ell}}\right)^2} F\left(-n_\xi, l_\xi+\frac{3}{2}, \left(\frac{\xi}{d_{\xi\ell}}\right)^2\right)$$

参数$d_{\xi l}$与谐振子频率$\omega_{\xi l}$的关系：　$\frac{1}{d_{\xi l}^2} = M_\xi \omega_{\xi l}$

d_l设为：　$d_l = d_1 \mathrm{a}^{l-1}\ (l = 1, \ldots, n)$

n是谐振子函数的个数
a是等比系数

计算方法

2S试探波函数展开：

$$\psi_{NLM}(\boldsymbol{\xi}_1,\boldsymbol{\xi}_2,\boldsymbol{\xi}_3)$$

$$= \psi_{nlm}(\boldsymbol{\xi}_1)\,\psi_{nlm}(\boldsymbol{\xi}_2)\,\psi_{nlm}(\boldsymbol{\xi}_3)$$

$$= \left(\sum_{l1=1}^{n} C_l^{(1)}\psi_{nlm}\left(\omega_l^{(1)}\boldsymbol{\xi}_1\right)\right)\left(\psi_{nlm}\left(\omega_l^{(2)}\boldsymbol{\xi}_2\right)\psi_{nlm}\left(\omega_l^{(2)}\boldsymbol{\xi}_3\right)\right)$$

激发态：多高斯展开

基态：单高斯

计算方法

一、求解广义本征值问题-确定质量和波函数

$$\sum_{l'=1}^{l}\left(H_{ll'}-EN_{ll'}\right)C_{l'}=0$$

二、对角化相同J^{PC}量子数质量矩阵获得物理态

eg.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{++}	$1^1S_{0^{++}(6\bar{6})_c}$ $1^1S_{0^{++}(\bar{3}3)_c}$	$\begin{pmatrix} 6518 & 45 \\ 45 & 6487 \end{pmatrix}$	$\begin{pmatrix} 6455 \\ 6550 \end{pmatrix}$	$\begin{pmatrix} (\ 0.58 & -0.81\ ) \\ (\ -0.81 & -0.58\ ) \end{pmatrix}$

计算结果

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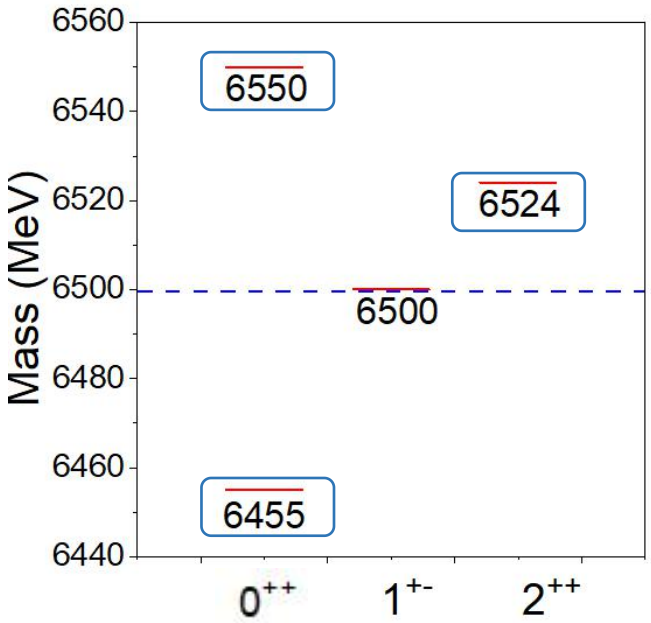
1S质量谱：

$J^{P(C)}$	Configuration	$\langle H \rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{++}	$1^1S_{0^{++}(6\bar{6})_c}$ $1^1S_{0^{++}(\bar{3}3)_c}$	$\begin{pmatrix} 6518 & 45 \\ 45 & 6487 \end{pmatrix}$	$\begin{pmatrix} 6455 \\ 6550 \end{pmatrix}$	$\begin{pmatrix} 0.58 & -0.81 \\ -0.81 & -0.58 \end{pmatrix}$
1^{+-}	$1^3S_{1^{+-}(\bar{3}3)_c}$	(6500)	6500	1
2^{++}	$1^5S_{2^{++}(\bar{3}3)_c}$	(6524)	6524	1

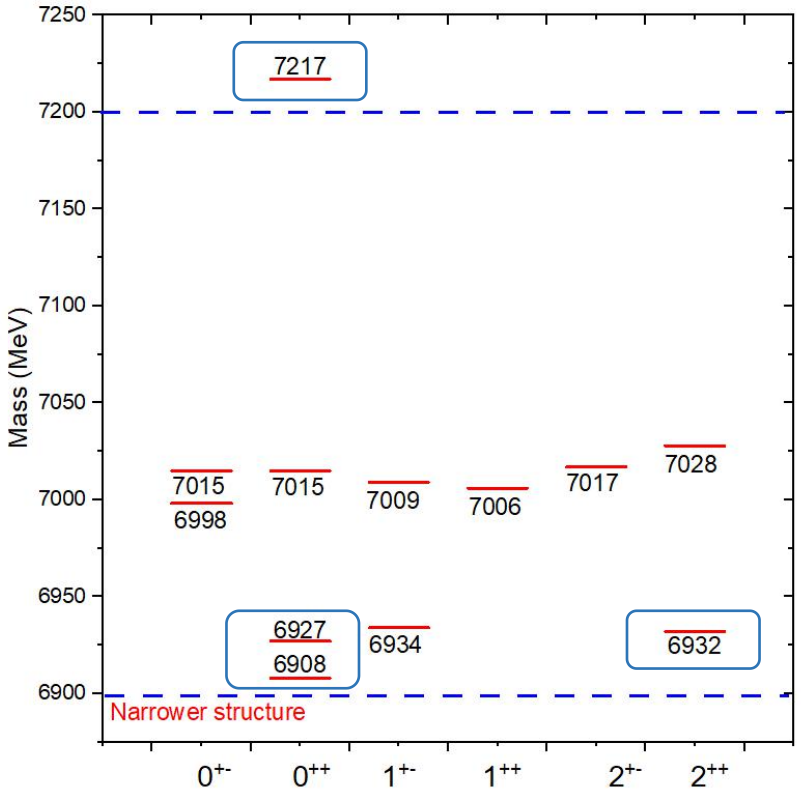


- 1S态的质量分布在6.4GeV~6.6GeV范围内。
- $T_{0^{++}}(6455)$、$T_{0^{++}}(6550)$、$T_{2^{++}}(6524)$对(6200-6800)有重要贡献，是X(6500)可能的候选者。

2S激发态质量谱：

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{+-}	$2^1S_{0^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$ $2^1S_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\begin{pmatrix} 7008 & -8 \\ -8 & 7005 \end{pmatrix}$	$\begin{pmatrix} 6998 \\ 7015 \end{pmatrix}$	$\begin{pmatrix} (-0.63 & -0.78) \\ (-0.78 & 0.63) \end{pmatrix}$
0^{++}	$2^1S_{0^{++}(6\bar{6})_c(\xi_1,\xi_2)}$ $2^1S_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$ $2^1S_{0^{++}(6\bar{6})_c(\xi_3)}$ $2^1S_{0^{++}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6954 & -19 & 93 & -8 \\ -19 & 7000 & -4 & -33 \\ 93 & -4 & 7183 & -12 \\ -8 & -33 & -12 & 6930 \end{pmatrix}$	$\begin{pmatrix} 6908 \\ 6927 \\ 7015 \\ 7217 \end{pmatrix}$	$\begin{pmatrix} (-0.62 & 0.69 & 0.13 & -0.34) \\ (-0.36 & -0.13 & -0.92 & 0.04) \\ (0.18 & -0.28 & -0.07 & -0.94) \\ (-0.67 & -0.65 & 0.35 & 0.04) \end{pmatrix}$
1^{+-}	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$ $2^3S_{1^{+-}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 7009 & 0 \\ 0 & 6934 \end{pmatrix}$	$\begin{pmatrix} 7009 \\ 6934 \end{pmatrix}$	$\begin{pmatrix} (1 & 0) \\ (0 & 1) \end{pmatrix}$
1^{++}	$2^3S_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\begin{pmatrix} 7006 \end{pmatrix}$	7006	1
2^{+-}	$2^5S_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\begin{pmatrix} 7017 \end{pmatrix}$	7017	1
2^{++}	$2^5S_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$ $2^5S_{2^{++}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 7018 & -29 \\ -29 & 6942 \end{pmatrix}$	$\begin{pmatrix} 7028 \\ 6932 \end{pmatrix}$	$\begin{pmatrix} (-0.95 & 0.32) \\ (0.32 & -0.95) \end{pmatrix}$

2S激发态的计算结果



- 2S态的质量分布在6.9GeV~7.3GeV范围内。
- $T_0{}^{++}(6908)$、$T_0{}^{++}(6927)$、$T_2{}^{++}(6932)$是X(6900)可能的候选者。
- $T_0{}^{++}(7217)$是X(7200)可能的候选者。

2S激发态的计算结果

$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$
0^{+-}	$2^1S_{0^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$	7008	706	899	-540	10
	$2^1S_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7005	776	924	-629	3
0^{++}	$2^1S_{0^{++}(6\bar{6})_c(\xi_1,\xi_2)}$	6954	725	883	-598	11
	$2^1S_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7000	774	919	-622	-4
	$2^1S_{0^{++}(6\bar{6})_c(\xi_3)}$	7183	757	1010	-522	7
	$2^1S_{0^{++}(\bar{3}3)_c(\xi_3)}$	6930	761	876	-642	3
1^{+-}	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7009	773	925	-628	7
	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_3)}$	6934	745	885	-634	6
1^{++}	$^3S_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7006	774	920	-622	2
2^{+-}	$2^5S_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7017	762	932	-624	15
2^{++}	$2^5S_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7018	753	932	-613	14
	$2^5S_{2^{++}(\bar{3}3)_c(\xi_3)}$	6942	741	888	-633	14

- $\langle T\rangle$、$\langle V^{Lin}\rangle$、$\langle V^{Coul}\rangle$对2S态有重要贡献。
- S-S相互作用的贡献很小，但对混合矩阵元有关键影响。

2S激发态的计算结果比较

$J^{P(C)}$	Configuration	Mass (MeV) Ours	Mass (MeV) Q. F. L
0^{+-}	$2^1S_{0^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$	6998	
	$2^1S_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7015	
0^{++}	$2^1S_{0^{++}(6\bar{6})_c(\xi_1,\xi_2)}$	6908	6849
	$2^1S_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	6927	6940
	$2^1S_{0^{++}(6\bar{6})_c(\xi_3)}$	7015	
	$2^1S_{0^{++}(\bar{3}3)_c(\xi_3)}$	7217	
1^{+-}	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	6934	6928
	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_3)}$	7009	
1^{++}	$2^3S_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7006	
2^{+-}	$2^5S_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7017	
2^{++}	$2^5S_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	6932	6947
	$2^5S_{2^{++}(\bar{3}3)_c(\xi_3)}$	7028	

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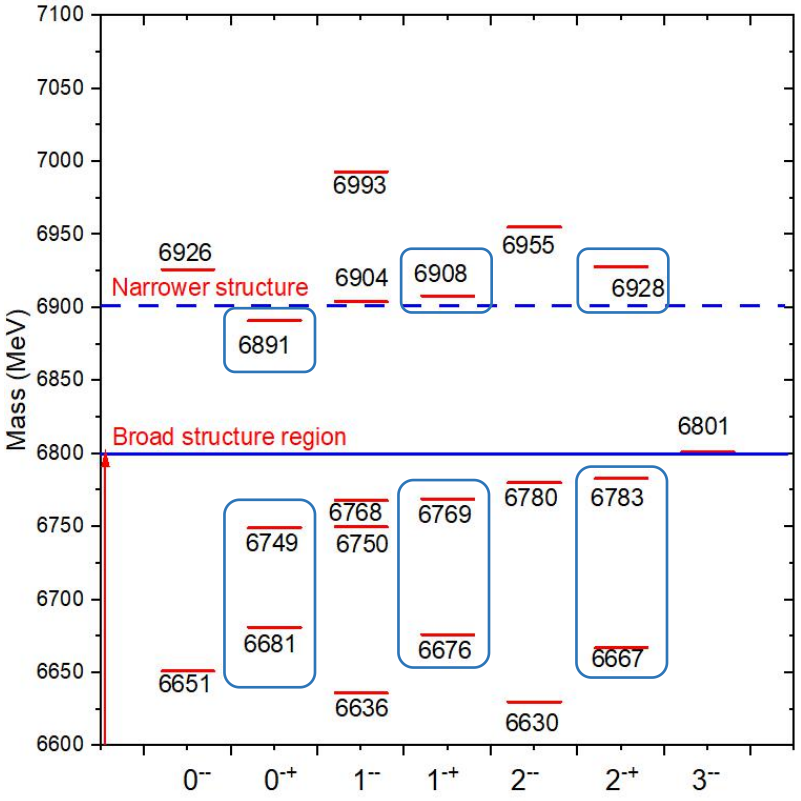
1P激发态的计算结果

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{--}	$^3P_{0^{--}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{0^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\begin{pmatrix} 6751 & -132 \\ -132 & 6827 \end{pmatrix}$	$\begin{pmatrix} 6651 \\ 6926 \end{pmatrix}$	$\begin{pmatrix} (-0.80 & -0.60) \\ (-0.6 & 0.80) \end{pmatrix}$
0^{-+}	$^3P_{0^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{0^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$ $^3P_{0^{-+}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6746 & 88 & 37 \\ 88 & 6825 & 18 \\ 37 & 18 & 6750 \end{pmatrix}$	$\begin{pmatrix} 6681 \\ 6749 \\ 6891 \end{pmatrix}$	$\begin{pmatrix} (0.82 & -0.47 & -0.32) \\ (-0.14 & 0.38 & 0.91) \\ (0.55 & 0.80 & 0.25) \end{pmatrix}$
1^{--}	$^3P_{1^{--}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{1^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$ $^5P_{1^{--}(\bar{3}3)_c(\xi_3)}$ $^1P_{1^{--}(\bar{3}3)_c(\xi_3)}$ $^1P_{1^{--}(6\bar{6})_c(\xi_3)}$	$\begin{pmatrix} 6733 & 132 & -29 & -16 & 31 \\ 132 & 6827 & -14 & -7 & 26 \\ -29 & -14 & 6754 & -3 & 10 \\ -16 & -7 & -3 & 6770 & -19 \\ 31 & 26 & 10 & -19 & 6968 \end{pmatrix}$	$\begin{pmatrix} 6636 \\ 6750 \\ 6768 \\ 6904 \\ 6993 \end{pmatrix}$	$\begin{pmatrix} (0.82 & -0.55 & 0.12 & 0.06 & -0.03) \\ (0.02 & -0.24 & -0.96 & -0.16 & 0.06) \\ (-0.01 & 0.05 & -0.17 & 0.98 & 0.10) \\ (-0.48 & -0.69 & 0.19 & 0.02 & 0.50) \\ (0.31 & 0.39 & -0.02 & -0.11 & 0.86) \end{pmatrix}$
1^{-+}	$^3P_{1^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{1^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$ $^3P_{1^{-+}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6751 & -108 & 9 \\ -108 & 6834 & -4 \\ 9 & -4 & 6769 \end{pmatrix}$	$\begin{pmatrix} 6676 \\ 6769 \\ 6908 \end{pmatrix}$	$\begin{pmatrix} (0.82 & 0.56 & -0.05) \\ (-0.01 & -0.08 & -1.00) \\ (-0.57 & 0.82 & -0.06) \end{pmatrix}$
2^{--}	$^3P_{2^{--}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{2^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$ $^5P_{2^{--}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6746 & -155 & -18 \\ -155 & 6837 & 9 \\ -18 & 9 & 6781 \end{pmatrix}$	$\begin{pmatrix} 6630 \\ 6780 \\ 6955 \end{pmatrix}$	$\begin{pmatrix} (0.80 & 0.59 & 0.06) \\ (-0.01 & 0.12 & -1.00) \\ (-0.60 & 0.80 & 0.10) \end{pmatrix}$
2^{-+}	$^3P_{2^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{2^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$ $^3P_{2^{-+}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6754 & 123 & 12 \\ 123 & 6841 & 6 \\ 12 & 6 & 6783 \end{pmatrix}$	$\begin{pmatrix} 6667 \\ 6783 \\ 6928 \end{pmatrix}$	$\begin{pmatrix} (0.82 & -0.57 & -0.06) \\ (0.00 & 0.10 & -1.00) \\ (0.58 & 0.81 & 0.08) \end{pmatrix}$
3^{--}	$^5P_{3^{--}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6801 \end{pmatrix}$	6801	1

1P激发态的计算结果



- 1P态的质量分布在6.6GeV~7.0GeV范围内。
- $T_0{}^{-+}(6681)$、$T_0{}^{-+}(6749)$、$T_1{}^{-+}(6676)$、$T_1{}^{-+}(6769)$、$T_1{}^{-+}(6667)$、$T_1{}^{-+}(6783)$是X(6500)可能的候选者。
- $T_0{}^{-+}(6891)$、$T_1{}^{-+}(6908)$、$T_2{}^{-+}(6928)$是X(6900)可能的候选者。

1P激发态的计算结果

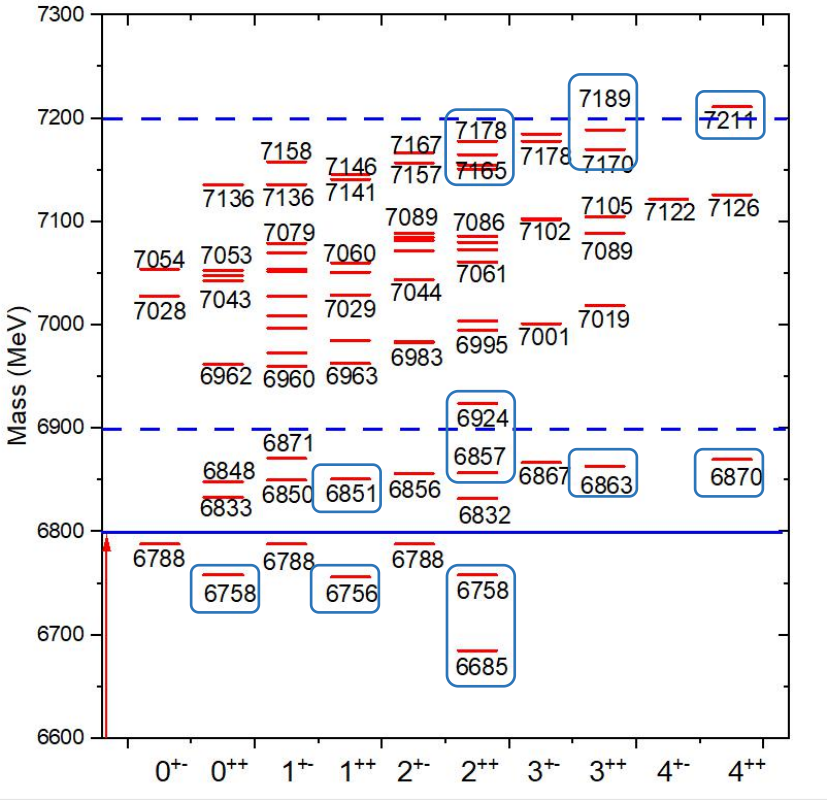
$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Conf}\rangle$	$\langle V^{OGE}_{coul}\rangle$	$\langle V^{OGE}_{SS}\rangle$	$\langle V^{OGE}_{tensor}\rangle$	$\langle V^{OGE}_{LS}\rangle$
0^{--}	$^3P_{0--(6\bar{6})_c(\xi_1,\xi_2)}$	6751	717	778	−686	1.62	12.92	−4.31
	$^3P_{0--(\bar{3}3)_c(\xi_1,\xi_2)}$	6827	741	810	−651	0.62	3.04	−9.11
0^{-+}	$^3P_{0-+(6\bar{6})_c(\xi_1,\xi_2)}$	6746	727	773	−691	11.59	−1.48	−4.43
	$^3P_{0-+(\bar{3}3)_c(\xi_1,\xi_2)}$	6825	745	808	−653	4.70	−3.07	−9.21
	$^3P_{0-+(\bar{3}3)_c(\xi_3)}$	6750	765	769	−694	4.22	−6.45	−19.35
1^{--}	$^3P_{1--(6\bar{6})_c(\xi_1,\xi_2)}$	6733	743	765	−699	1.73	−6.89	−2.30
	$^3P_{1--(\bar{3}3)_c(\xi_1,\xi_2)}$	6827	741	810	−651	0.62	−1.52	−4.55
	$^5P_{1--(\bar{3}3)_c(\xi_3)}$	6754	761	771	−692	15.62	−4.47	−28.76
	$^1P_{1--(\bar{3}3)_c(\xi_3)}$	6770	734	784	−679	−1.38	0	0
	$^1P_{1--(6\bar{6})_c(\xi_3)}$	6968	714	885	−578	13.51	0	0
1^{-+}	$^3P_{1-+(6\bar{6})_c(\xi_1,\xi_2)}$	6751	720	776	−688	11.45	0.73	−2.18
	$^3P_{1-+(\bar{3}3)_c(\xi_1,\xi_2)}$	6834	732	815	−647	4.63	1.49	−4.46
	$^3P_{1-+(\bar{3}3)_c(\xi_3)}$	6769	736	783	−680	4.03	3.01	−9.03
2^{--}	$^3P_{2--(6\bar{6})_c(\xi_1,\xi_2)}$	6746	724	774	−690	1.65	1.32	2.19
	$^3P_{2--(\bar{3}3)_c(\xi_1,\xi_2)}$	6837	725	819	−644	0.64	0.29	4.38
	$^5P_{2--(\bar{3}3)_c(\xi_3)}$	6781	720	791	−672	14.38	4.05	−8.69
2^{-+}	$^3P_{2-+(6\bar{6})_c(\xi_1,\xi_2)}$	6754	715	779	−685	11.35	−0.14	2.15
	$^3P_{2-+(\bar{3}3)_c(\xi_1,\xi_2)}$	6841	722	821	−642	4.57	−0.29	4.35
	$^3P_{2-+(\bar{3}3)_c(\xi_3)}$	6783	715	794	−670	3.89	−0.57	8.59
3^{--}	$^5P_{3--(\bar{3}3)_c(\xi_3)}$	6801	692	807	−658	13.55	−1.08	16.20

- 主要贡献来自于$\langle T\rangle$、$\langle V^{Lin}\rangle$、$\langle V^{Coul}\rangle$。

1D激发态的计算结果

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{+-}	$1^3P_{0^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$ $1^3P_{0^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\begin{pmatrix} 6868 & -113 \\ -113 & 6948 \end{pmatrix}$	$\begin{pmatrix} 6788 \\ 7028 \end{pmatrix}$	$\begin{pmatrix} (-0.82 & -0.58) \\ (-0.58 & 0.82) \end{pmatrix}$
	$1^5D_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	(7054)	7054	1
0^{++}	$1^1S_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$ $1^1S_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\begin{pmatrix} 6838 & -24 \\ -24 & 6957 \end{pmatrix}$	$\begin{pmatrix} 6833 \\ 6962 \end{pmatrix}$	$\begin{pmatrix} (-0.98 & -0.19) \\ (-0.19 & 0.98) \end{pmatrix}$
	$1^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	(7053)	7053	1
	$1^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$ $1^3P_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\begin{pmatrix} 6857 & 136 \\ 136 & 6944 \end{pmatrix}$	$\begin{pmatrix} 6758 \\ 7043 \end{pmatrix}$	$\begin{pmatrix} (-0.81 & 0.59) \\ (0.59 & 0.81) \end{pmatrix}$
	$1^5D_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$ $1^5D_{0^{++}(\bar{3}3)_c(\xi_3)}$ $1^5D_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\begin{pmatrix} 7051 & 61 & 6 \\ 61 & 6968 & -128 \\ 6 & -128 & 7013 \end{pmatrix}$	$\begin{pmatrix} 7048 \\ 6848 \\ 7136 \end{pmatrix}$	$\begin{pmatrix} (0.88 & -0.09 & 0.47) \\ (-0.25 & 0.76 & 0.6) \\ (0.41 & 0.64 & -0.65) \end{pmatrix}$

1D激发态的计算结果



- 1D态的质量分布在6.6GeV~7.3GeV范围内。
- $T_0{}^{++}(6758)$、$T_1{}^{++}(6756)$、$T_2{}^{++}(6685)$、$T_2{}^{++}(6758)$是X(6500)可能的候选者。
- $T_1{}^{++}(6851)$、$T_2{}^{++}(6857)$、$T_2{}^{++}(6924)$、$T_3{}^{++}(6863)$、$T_4{}^{++}(6870)$是X(6900)可能的候选者。
- $T_2{}^{++}(7165)$、$T_2{}^{++}(7178)$、$T_3{}^{++}(7170)$、$T_3{}^{++}(7189)$、$T_4{}^{++}(7211)$是X(7200)可能的候选者。

1D激发态的计算结果

$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$	$\langle V^{T}\rangle$	$\langle V^{LS}\rangle$
0^{+-}	$1^3P_{0^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6868	732	837	-636	6.18	0	-2.28
	$1^3P_{0^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6948	749	876	-601	-2.66	0	-4.73
	$1^5D_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7054	809	924	-572	9.25	-5.91	-43.52
0^{++}	$1^1S_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$	6838	769	818	-657	-24.14	0	0
	$1^1S_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	6957	788	877	-603	-37.55	0	0
	$1^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6857	745	830	-642	-2.02	-2.35	-2.35
	$1^3P_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6944	754	873	-603	-6.08	-0.96	-4.79
	$1^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7053	775	925	-553	-15.43	2.49	-12.47
	$1^5D_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7051	798	927	-577	9.84	-4.46	-35.39
	$1^5D_{0^{++}(\bar{3}3)_c(\xi_3)}$	6968	783	883	-603	10.84	-4.59	-32.12
	$1^5D_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7013	802	902	-585	9.78	-5.96	-41.73

混合矩阵元：

1^{--}

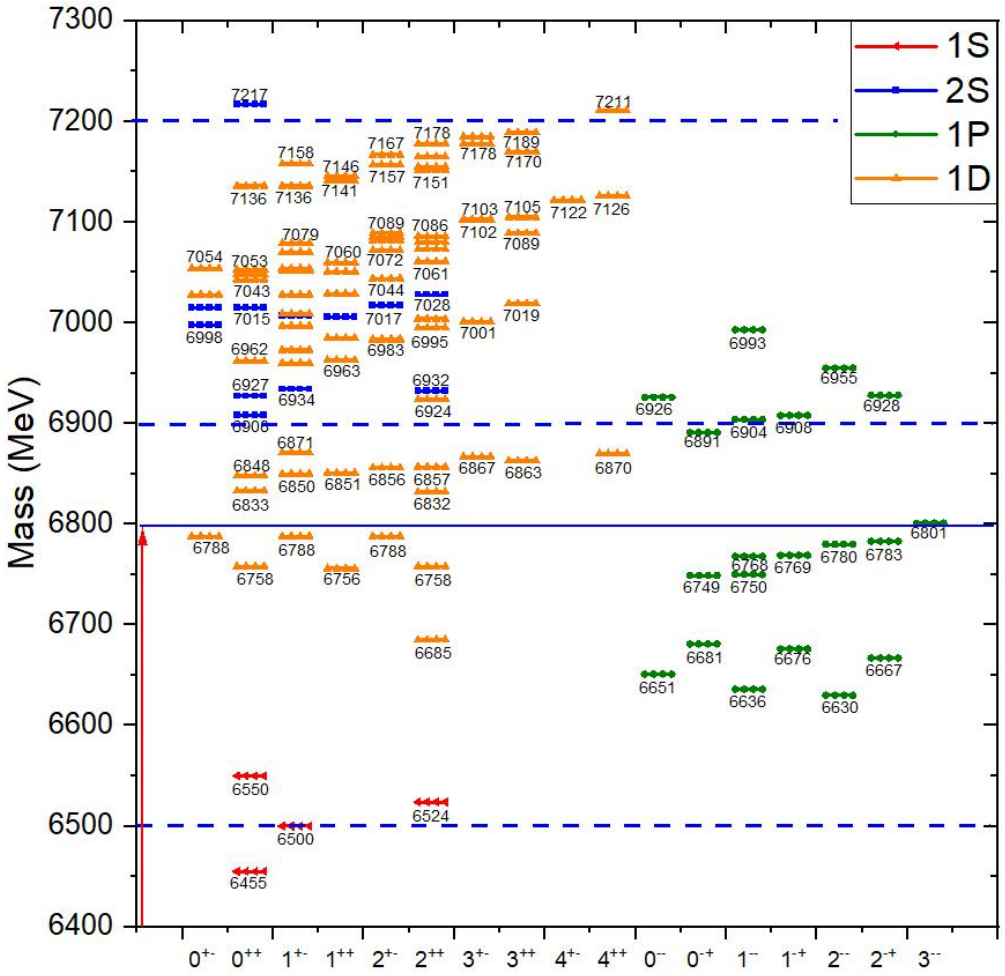
$$
\begin{array}{l}
{}^3P_{1^{--}(6\bar{6})_c(\xi_1,\xi_2)} \\
{}^3P_{1^{--}(\bar{3}3)_c(\xi_1,\xi_2)} \\
{}^5P_{1^{--}(\bar{3}3)_c(\xi_3)} \\
{}^1P_{1^{--}(\bar{3}3)_c(\xi_3)} \\
{}^1P_{1^{--}(6\bar{6})_c(\xi_3)}
\end{array}
\begin{pmatrix}
6733 & 132 & -29 & -16 & 31 \\
132 & 6827 & -14 & -7 & 26 \\
-29 & -14 & 6754 & -3 & 10 \\
-16 & -7 & -3 & 6770 & -19 \\
31 & 26 & 10 & -19 & 6968
\end{pmatrix}
$$

$$
\begin{array}{l}
\frac{1}{2}\left(\psi^{\xi_1}_{011}\chi^{10}_{10}-\psi^{\xi_1}_{010}\chi^{10}_{11}-\psi^{\xi_2}_{011}\chi^{01}_{10}+\psi^{\xi_2}_{010}\chi^{01}_{11}\right) \\
\frac{1}{2}\left(\psi^{\xi_1}_{011}\chi^{01}_{10}-\psi^{\xi_1}_{010}\chi^{01}_{11}-\psi^{\xi_2}_{011}\chi^{10}_{10}+\psi^{\xi_2}_{010}\chi^{10}_{11}\right) \\
\sqrt{\frac{1}{10}}\psi^{\xi_3}_{011}\chi^{11}_{20}-\sqrt{\frac{3}{10}}\psi^{\xi_3}_{010}\chi^{11}_{21}+\sqrt{\frac{3}{5}}\psi^{\xi_3}_{01-1}\chi^{11}_{22} \\
\psi^{\xi_3}_{011}\chi^{11}_{00} \\
\psi^{\xi_3}_{011}\chi^{00}_{00}
\end{array}
$$

Mass	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$	$\langle V^{T}\rangle$	$\langle V^{LS}\rangle$
132	64	66	16	-3	-10
-29	0	0	0	-11	-18
-19	0	0	-19	0	0

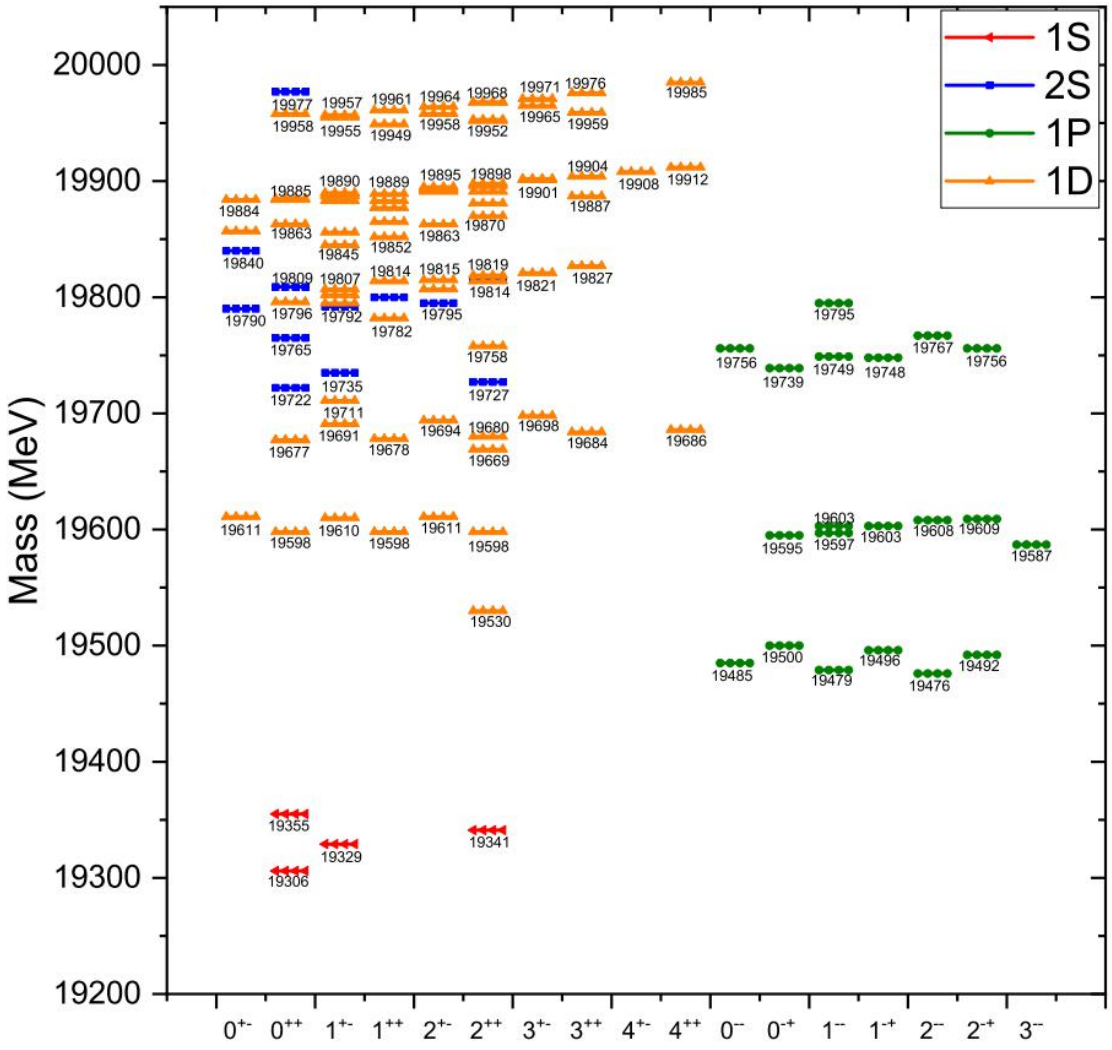
- 不同颜色结构也有混合。
- $\chi^{S_{12}S_{34}}_{S\,S_m}$相同时，$V^{Lin}$、$V^{Coul}$和$V^{SS}$有较大的贡献。
- $S\,S_m$相同时，V^{SS}有贡献。

$cc\bar{c}\bar{c}$质量谱



- 1S态$T_0^{++}(6455)$、$T_0^{++}(6550)$、$T_2^{++}(6524)$对(6200-6800)有重要贡献，
  1P态$T_0^{-+}(6681)$、$T_0^{-+}(6749)$、$T_1^{-+}(6676)$、$T_1^{-+}(6769)$、$T_1^{-+}(6667)$、$T_1^{-+}(6783)$，
  1D态$T_0^{++}(6758)$、$T_1^{++}(6756)$、$T_2^{++}(6685)$、$T_2^{++}(6758)$都是X(6500)可能的候选者。
- 2S态$T_0^{++}(6908)$、$T_0^{++}(6927)$、$T_2^{++}(6932)$，
  1P态$T_0^{-+}(6891)$、$T_1^{-+}(6908)$、$T_2^{-+}(6928)$，
  1D态$T_1^{++}(6851)$、$T_2^{++}(6857)$、$T_2^{++}(6924)$、$T_3^{++}(6863)$、$T_4^{++}(6870)$是X(6900)可能的候选者。
- 2S态$T_0^{++}(7217)$
  1D态$T_2^{++}(7165)$、$T_2^{++}(7178)$、$T_3^{++}(7170)$、$T_3^{++}(7189)$、$T_4^{++}(7211)$是X(7200)可能的候选者。
- 需要进一步研究衰变性质。

$bb\bar{b}\bar{b}$质量谱



谢谢

TABLE I: Configurations for the tetraquark $qq\bar{q}\bar{q}$ system.

$J^{P(C)}$	Configuration	Wave Function	
$J^{PC}=0^{++}$	$1^1S_{0^{++}(6\bar{6})_c}$	$\psi^{1S}_{000}\chi^{00}_{00}$	$\|6\bar{6}\rangle^c$
$J^{PC}=0^{++}$	$1^1S_{0^{++}(\bar{3}3)_c}$	$\psi^{1S}_{000}\chi^{11}_{00}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{+-}$	$1^3S_{1^{+-}(\bar{3}3)_c}$	$\psi^{1S}_{000}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$1^5S_{2^{++}(\bar{3}3)_c}$	$\psi^{1S}_{000}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$

TABLE II: Configurations for the tetraquark $qq\bar{q}\bar{q}$ system up to the $2S$-wave states. ξ_1, ξ_2, ξ_3 are the Jacobi coordinates. (ξ_1, ξ_2) stands for a configuration containing both ξ_1- and ξ_2-mode orbital excitations.

$J^{P(C)}$	Configuration	Wave Function	
$J^{PC}=0^{+-}$	$2^1S_{0^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{100}\chi^{00}_{00}-\psi^{\xi_2}_{100}\chi^{00}_{00}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=0^{+-}$	$2^1S_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{100}\chi^{11}_{00}-\psi^{\xi_2}_{100}\chi^{11}_{00}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=0^{++}$	$2^1S_{0^{++}(6\bar{6})_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{100}\chi^{00}_{00}+\psi^{\xi_2}_{100}\chi^{00}_{00}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=0^{++}$	$2^1S_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{100}\chi^{11}_{00}+\psi^{\xi_2}_{100}\chi^{11}_{00}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=0^{++}$	$2^1S_{0^{++}(6\bar{6})_c(\xi_3)}$	$\psi^{\xi_3}_{100}\chi^{00}_{00}$	$\|6\bar{6}\rangle^c$
$J^{PC}=0^{++}$	$2^1S_{0^{++}(\bar{3}3)_c(\xi_3)}$	$\psi^{\xi_3}_{100}\chi^{11}_{00}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{+-}$	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{100}\chi^{11}_{11}-\psi^{\xi_2}_{100}\chi^{11}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{+-}$	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_3)}$	$\psi^{\xi_3}_{100}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{++}$	$2^3S_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{100}\chi^{11}_{11}+\psi^{\xi_2}_{100}\chi^{11}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{+-}$	$2^5S_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{100}\chi^{11}_{22}-\psi^{\xi_2}_{100}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$2^5S_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{100}\chi^{11}_{22}+\psi^{\xi_2}_{100}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$2^5S_{2^{++}(\bar{3}3)_c(\xi_3)}$	$\psi^{\xi_3}_{100}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$

TABLE III: Configurations for the tetraquark $qq\bar{q}\bar{q}$ system up to the $1P$-wave states. ξ_1, ξ_2, ξ_3 are the Jacobi coordinates. (ξ_1, ξ_2) stands for a configuration containing both ξ_1- and ξ_2-mode orbital excitations.

$J^{P(C)}$	Configuration	Wave Function	
$J^{PC}=0^{--}$	$1^3P_{0^{--}(6\bar{6})_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1}_{011}\chi^{10}_{1-1}-\psi^{\xi_1}_{010}\chi^{10}_{10}+\psi^{\xi_1}_{01-1}\chi^{10}_{11}-\psi^{\xi_2}_{011}\chi^{01}_{1-1}+\psi^{\xi_2}_{010}\chi^{01}_{10}-\psi^{\xi_2}_{01-1}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=0^{--}$	$1^3P_{0^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1}_{011}\chi^{01}_{1-1}-\psi^{\xi_1}_{010}\chi^{01}_{10}+\psi^{\xi_1}_{01-1}\chi^{01}_{11}-\psi^{\xi_2}_{011}\chi^{10}_{1-1}+\psi^{\xi_2}_{010}\chi^{10}_{10}-\psi^{\xi_2}_{01-1}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=0^{-+}$	$1^3P_{0^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1}_{011}\chi^{10}_{1-1}-\psi^{\xi_1}_{010}\chi^{10}_{10}+\psi^{\xi_1}_{01-1}\chi^{10}_{11}+\psi^{\xi_2}_{011}\chi^{01}_{1-1}-\psi^{\xi_2}_{010}\chi^{01}_{10}+\psi^{\xi_2}_{01-1}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=0^{-+}$	$1^3P_{0^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1}_{011}\chi^{01}_{1-1}-\psi^{\xi_1}_{010}\chi^{01}_{10}+\psi^{\xi_1}_{01-1}\chi^{01}_{11}+\psi^{\xi_2}_{011}\chi^{10}_{1-1}-\psi^{\xi_2}_{010}\chi^{10}_{10}+\psi^{\xi_2}_{01-1}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=0^{-+}$	$1^3P_{0^{-+}(\bar{3}3)_c(\xi_3)}$	$\sqrt{\frac{1}{3}}\left(\psi^{\xi_3}_{011}\chi^{11}_{1-1}-\psi^{\xi_3}_{010}\chi^{11}_{10}+\psi^{\xi_3}_{01-1}\chi^{11}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{--}$	$1^3P_{1^{--}(6\bar{6})_c(\xi_1,\xi_2)}$	$\frac{1}{2}\left(\psi^{\xi_1}_{011}\chi^{10}_{10}-\psi^{\xi_1}_{010}\chi^{10}_{11}-\psi^{\xi_2}_{011}\chi^{01}_{10}+\psi^{\xi_2}_{010}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{--}$	$1^3P_{1^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\frac{1}{2}\left(\psi^{\xi_1}_{011}\chi^{01}_{10}-\psi^{\xi_1}_{010}\chi^{01}_{11}-\psi^{\xi_2}_{011}\chi^{10}_{10}+\psi^{\xi_2}_{010}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{--}$	$1^5P_{1^{--}(\bar{3}3)_c(\xi_3)}$	$\sqrt{\frac{1}{10}}\psi^{\xi_3}_{011}\chi^{11}_{20}-\sqrt{\frac{3}{10}}\psi^{\xi_3}_{010}\chi^{11}_{21}+\sqrt{\frac{3}{5}}\psi^{\xi_3}_{01-1}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{--}$	$1^1P_{1^{--}(\bar{3}3)_c(\xi_3)}$	$\psi^{\xi_3}_{011}\chi^{11}_{00}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{--}$	$1^1P_{1^{--}(6\bar{6})_c(\xi_3)}$	$\psi^{\xi_3}_{011}\chi^{00}_{00}$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{-+}$	$1^3P_{1^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$	$\frac{1}{2}\left(\psi^{\xi_1}_{011}\chi^{10}_{10}-\psi^{\xi_1}_{010}\chi^{10}_{11}+\psi^{\xi_2}_{011}\chi^{01}_{10}-\psi^{\xi_2}_{010}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{-+}$	$1^3P_{1^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\frac{1}{2}\left(\psi^{\xi_1}_{011}\chi^{01}_{10}-\psi^{\xi_1}_{010}\chi^{01}_{11}+\psi^{\xi_2}_{011}\chi^{10}_{10}-\psi^{\xi_2}_{010}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{-+}$	$1^3P_{1^{-+}(\bar{3}3)_c(\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_3}_{011}\chi^{11}_{10}-\psi^{\xi_3}_{010}\chi^{11}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{--}$	$1^3P_{2^{--}(6\bar{6})_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{011}\chi^{10}_{11}-\psi^{\xi_2}_{011}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{--}$	$1^3P_{2^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{011}\chi^{01}_{11}-\psi^{\xi_2}_{011}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{--}$	$1^5P_{2^{--}(\bar{3}3)_c(\xi_3)}$	$\sqrt{\frac{1}{3}}\psi^{\xi_3}_{011}\chi^{11}_{21}-\sqrt{\frac{2}{3}}\psi^{\xi_3}_{010}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{-+}$	$1^3P_{2^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{011}\chi^{10}_{11}+\psi^{\xi_2}_{011}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{-+}$	$1^3P_{2^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{011}\chi^{01}_{11}+\psi^{\xi_2}_{011}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{-+}$	$1^3P_{2^{-+}(\bar{3}3)_c(\xi_3)}$	$\psi^{\xi_3}_{011}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=3^{--}$	$1^5P_{3^{--}(\bar{3}3)_c(\xi_3)}$	$\psi^{\xi_3}_{011}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$

TABLE IV: Configurations for the tetraquark $qq\bar{q}\bar{q}$ system up to the $1D$-wave states.ξ_1, ξ_2, ξ_3 are the Jacobi coordinates. (ξ_1, ξ_2) stands for a configuration containing both ξ_1- and ξ_2-mode orbital excitations. $\xi_i \otimes \xi_j$ means two independent internal $\psi_{n_{\xi_i} l_{\xi_i} m_{\xi_i}}(\boldsymbol{\xi}_i)$ and $\psi_{n_{\xi_j} l_{\xi_j} m_{\xi_j}}(\boldsymbol{\xi}_j)$ wave functions excited.

$J^{P(C)}$	Configuration	Wave Function	
$J^{PC}=0^{+-}$	$1^3P_{0^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{1-1}-\psi^{\xi_1\xi_3}_{010}\chi^{10}_{10}+\psi^{\xi_1\xi_3}_{01-1}\chi^{10}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{01}_{1-1}+\psi^{\xi_2\xi_3}_{010}\chi^{01}_{10}-\psi^{\xi_2\xi_3}_{01-1}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=0^{+-}$	$1^3P_{0^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{1-1}-\psi^{\xi_1\xi_3}_{010}\chi^{01}_{10}+\psi^{\xi_1\xi_3}_{01-1}\chi^{01}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{10}_{1-1}+\psi^{\xi_2\xi_3}_{010}\chi^{10}_{10}-\psi^{\xi_2\xi_3}_{01-1}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=0^{+-}$	$1^5D_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{10}}(\psi^{\xi_1}_{022}\chi^{11}_{2-2}-\psi^{\xi_1}_{021}\chi^{11}_{2-1}+\psi^{\xi_1}_{020}\chi^{11}_{20}-\psi^{\xi_1}_{02-1}\chi^{11}_{21}+\psi^{\xi_1}_{02-2}\chi^{11}_{22}$ $-\psi^{\xi_2}_{022}\chi^{11}_{2-2}+\psi^{\xi_2}_{021}\chi^{11}_{2-1}-\psi^{\xi_2}_{020}\chi^{11}_{20}+\psi^{\xi_2}_{02-1}\chi^{11}_{21}-\psi^{\xi_2}_{02-2}\chi^{11}_{22})$	$\|\bar{3}3\rangle^c$
$J^{PC}=0^{++}$	$1^1S_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{000}\chi^{00}_{00}$	$\|\bar{3}3\rangle^c$
$J^{PC}=0^{++}$	$1^1S_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{000}\chi^{11}_{00}$	$\|6\bar{6}\rangle^c$
$J^{PC}=0^{++}$	$1^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{1-1}-\psi^{\xi_1\xi_3}_{010}\chi^{10}_{10}+\psi^{\xi_1\xi_3}_{01-1}\chi^{10}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{01}_{1-1}-\psi^{\xi_2\xi_3}_{010}\chi^{01}_{10}+\psi^{\xi_2\xi_3}_{01-1}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=0^{++}$	$1^3P_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{6}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{1-1}-\psi^{\xi_1\xi_3}_{010}\chi^{01}_{10}+\psi^{\xi_1\xi_3}_{01-1}\chi^{01}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{10}_{1-1}-\psi^{\xi_2\xi_3}_{010}\chi^{10}_{10}+\psi^{\xi_2\xi_3}_{01-1}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=0^{++}$	$1^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\sqrt{\frac{1}{3}}\left(\psi^{\xi_1\xi_2}_{011}\chi^{11}_{1-1}-\psi^{\xi_1\xi_2}_{010}\chi^{11}_{10}+\psi^{\xi_1\xi_2}_{01-1}\chi^{11}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=0^{++}$	$1^5D_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{10}}(\psi^{\xi_1}_{022}\chi^{11}_{2-2}-\psi^{\xi_1}_{021}\chi^{11}_{2-1}+\psi^{\xi_1}_{020}\chi^{11}_{20}-\psi^{\xi_1}_{02-1}\chi^{11}_{21}+\psi^{\xi_1}_{02-2}\chi^{11}_{22}$ $+\psi^{\xi_2}_{022}\chi^{11}_{2-2}-\psi^{\xi_2}_{021}\chi^{11}_{2-1}+\psi^{\xi_2}_{020}\chi^{11}_{20}-\psi^{\xi_2}_{02-1}\chi^{11}_{21}+\psi^{\xi_2}_{02-2}\chi^{11}_{22})$	$\|\bar{3}3\rangle^c$
$J^{PC}=0^{++}$	$1^5D_{0^{++}(\bar{3}3)_c(\xi_3)}$	$\sqrt{\frac{1}{5}}\left(\psi^{\xi_3}_{022}\chi^{11}_{2-2}-\psi^{\xi_3}_{021}\chi^{11}_{2-1}+\psi^{\xi_3}_{020}\chi^{11}_{20}-\psi^{\xi_3}_{02-1}\chi^{11}_{21}+\psi^{\xi_3}_{02-2}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=0^{++}$	$1^5D_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\sqrt{\frac{1}{5}}\left(\psi^{\xi_1\xi_2}_{022}\chi^{11}_{2-2}-\psi^{\xi_1\xi_2}_{021}\chi^{11}_{2-1}+\psi^{\xi_1\xi_2}_{020}\chi^{11}_{20}-\psi^{\xi_1\xi_2}_{02-1}\chi^{11}_{21}+\psi^{\xi_1\xi_2}_{02-2}\chi^{11}_{22}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{+-}$	$1^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{000}\chi^{10}_{11}-\psi^{\xi_2\xi_3}_{000}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{+-}$	$1^3S_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{000}\chi^{01}_{11}-\psi^{\xi_2\xi_3}_{000}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{+-}$	$1^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{000}\chi^{11}_{11}$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{+-}$	$1^1P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{011}\chi^{00}_{00}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{+-}$	$1^1P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{011}\chi^{11}_{00}$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{+-}$	$1^3P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\frac{1}{2}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{10}-\psi^{\xi_1\xi_3}_{010}\chi^{10}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{01}_{10}+\psi^{\xi_2\xi_3}_{010}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{+-}$	$1^3P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\frac{1}{2}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{10}-\psi^{\xi_1\xi_3}_{010}\chi^{01}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{10}_{10}+\psi^{\xi_2\xi_3}_{010}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{+-}$	$1^5P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\sqrt{\frac{1}{10}}\psi^{\xi_1\xi_2}_{011}\chi^{11}_{20}-\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_2}_{010}\chi^{11}_{21}+\sqrt{\frac{3}{5}}\psi^{\xi_1\xi_2}_{01-1}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{+-}$	$1^3D_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{3}{10}}\psi^{\xi_1}_{022}\chi^{11}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1}_{021}\chi^{11}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1}_{020}\chi^{11}_{11}-\sqrt{\frac{3}{10}}\psi^{\xi_2}_{022}\chi^{11}_{1-1}+\sqrt{\frac{3}{20}}\psi^{\xi_2}_{021}\chi^{11}_{10}-\sqrt{\frac{1}{20}}\psi^{\xi_2}_{020}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{+-}$	$1^3D_{1^{+-}(\bar{3}3)_c(\xi_3)}$	$\sqrt{\frac{3}{5}}\psi^{\xi_3}_{022}\chi^{11}_{1-1}-\sqrt{\frac{3}{10}}\psi^{\xi_3}_{021}\chi^{11}_{10}+\sqrt{\frac{1}{10}}\psi^{\xi_3}_{020}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{+-}$	$1^3D_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_3}_{022}\chi^{10}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1\xi_3}_{021}\chi^{10}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1\xi_3}_{020}\chi^{10}_{11}$ $-\sqrt{\frac{3}{10}}\psi^{\xi_2\xi_3}_{022}\chi^{01}_{1-1}+\sqrt{\frac{3}{20}}\psi^{\xi_2\xi_3}_{021}\chi^{01}_{10}-\sqrt{\frac{1}{20}}\psi^{\xi_2\xi_3}_{020}\chi^{01}_{11}$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{+-}$	$1^3D_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_3}_{022}\chi^{01}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1\xi_3}_{021}\chi^{01}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1\xi_3}_{020}\chi^{01}_{11}$ $-\sqrt{\frac{3}{10}}\psi^{\xi_2\xi_3}_{022}\chi^{10}_{1-1}+\sqrt{\frac{3}{20}}\psi^{\xi_2\xi_3}_{021}\chi^{10}_{10}-\sqrt{\frac{1}{20}}\psi^{\xi_2\xi_3}_{020}\chi^{10}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{+-}$	$1^3D_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\sqrt{\frac{3}{5}}\psi^{\xi_1\xi_2}_{022}\chi^{11}_{1-1}-\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_2}_{021}\chi^{11}_{10}+\sqrt{\frac{1}{10}}\psi^{\xi_1\xi_2}_{020}\chi^{11}_{11}$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{+-}$	$1^5D_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{10}}\psi^{\xi_1}_{022}\chi^{11}_{2-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1}_{021}\chi^{11}_{20}+\sqrt{\frac{3}{20}}\psi^{\xi_1}_{020}\chi^{11}_{21}-\sqrt{\frac{1}{10}}\psi^{\xi_1}_{02-1}\chi^{11}_{22}$ $-\sqrt{\frac{1}{10}}\psi^{\xi_2}_{022}\chi^{11}_{2-1}+\sqrt{\frac{3}{20}}\psi^{\xi_2}_{021}\chi^{11}_{20}-\sqrt{\frac{3}{20}}\psi^{\xi_2}_{020}\chi^{11}_{21}+\sqrt{\frac{1}{10}}\psi^{\xi_2}_{02-1}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{++}$	$1^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{000}\chi^{10}_{11}+\psi^{\xi_2\xi_3}_{000}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{++}$	$1^3S_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{000}\chi^{01}_{11}+\psi^{\xi_2\xi_3}_{000}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{++}$	$1^3P_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\frac{1}{2}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{10}-\psi^{\xi_1\xi_3}_{010}\chi^{10}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{01}_{10}-\psi^{\xi_2\xi_3}_{010}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{++}$	$1^3P_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\frac{1}{2}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{10}-\psi^{\xi_1\xi_3}_{010}\chi^{01}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{10}_{10}-\psi^{\xi_2\xi_3}_{010}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{++}$	$1^3P_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_2}_{011}\chi^{11}_{10}-\psi^{\xi_1\xi_2}_{010}\chi^{11}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{++}$	$1^3D_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{3}{10}}\psi^{\xi_1}_{022}\chi^{11}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1}_{021}\chi^{11}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1}_{020}\chi^{11}_{11}+\sqrt{\frac{3}{10}}\psi^{\xi_2}_{022}\chi^{11}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_2}_{021}\chi^{11}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_2}_{020}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{++}$	$1^3D_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_3}_{022}\chi^{10}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1\xi_3}_{021}\chi^{10}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1\xi_3}_{020}\chi^{10}_{11}$ $+\sqrt{\frac{3}{10}}\psi^{\xi_2\xi_3}_{022}\chi^{01}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_2\xi_3}_{021}\chi^{01}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_2\xi_3}_{020}\chi^{01}_{11}$	$\|6\bar{6}\rangle^c$
$J^{PC}=1^{++}$	$1^3D_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_3}_{022}\chi^{01}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1\xi_3}_{021}\chi^{01}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_1\xi_3}_{020}\chi^{01}_{11}$ $+\sqrt{\frac{3}{10}}\psi^{\xi_2\xi_3}_{022}\chi^{10}_{1-1}-\sqrt{\frac{3}{20}}\psi^{\xi_2\xi_3}_{021}\chi^{10}_{10}+\sqrt{\frac{1}{20}}\psi^{\xi_2\xi_3}_{020}\chi^{10}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{++}$	$1^5D_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{10}}\psi^{\xi_1}_{022}\chi^{11}_{2-1}-\sqrt{\frac{3}{20}}\psi^{\xi_1}_{021}\chi^{11}_{20}+\sqrt{\frac{3}{20}}\psi^{\xi_1}_{020}\chi^{11}_{21}-\sqrt{\frac{1}{10}}\psi^{\xi_1}_{02-1}\chi^{11}_{22}$ $+\sqrt{\frac{1}{10}}\psi^{\xi_2}_{022}\chi^{11}_{2-1}-\sqrt{\frac{3}{20}}\psi^{\xi_2}_{021}\chi^{11}_{20}+\sqrt{\frac{3}{20}}\psi^{\xi_2}_{020}\chi^{11}_{21}-\sqrt{\frac{1}{10}}\psi^{\xi_2}_{02-1}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{++}$	$1^5D_{1^{++}(\bar{3}3)_c(\xi_3)}$	$\sqrt{\frac{1}{5}}\psi^{\xi_3}_{022}\chi^{11}_{2-1}-\sqrt{\frac{3}{10}}\psi^{\xi_3}_{021}\chi^{11}_{20}+\sqrt{\frac{3}{10}}\psi^{\xi_3}_{020}\chi^{11}_{21}-\sqrt{\frac{1}{5}}\psi^{\xi_3}_{02-1}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
$J^{PC}=1^{++}$	$1^5D_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\sqrt{\frac{1}{5}}\psi^{\xi_1\xi_2}_{022}\chi^{11}_{2-1}-\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_2}_{021}\chi^{11}_{20}+\sqrt{\frac{3}{10}}\psi^{\xi_1\xi_2}_{020}\chi^{11}_{21}-\sqrt{\frac{1}{5}}\psi^{\xi_1\xi_2}_{02-1}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$

TABLE V: Configurations for the tetraquark $qq\bar{q}\bar{q}$ system up to the $1D$-wave states. ξ_1, ξ_2, ξ_3 are the Jacobi coordinates. (ξ_1, ξ_2) stands for a configuration containing both ξ_1- and ξ_2-mode orbital excitations. $\xi_i \otimes \xi_j$ means two independent internal $\psi_{n_{\xi_i} l_{\xi_i} m_{\xi_i}}(\boldsymbol{\xi}_i)$ and $\psi_{n_{\xi_j} l_{\xi_j} m_{\xi_j}}(\boldsymbol{\xi}_j)$ wave functions excited.

$J^{P(C)}$	Configuration	Wave Function	
$J^{PC}=2^{+-}$	$1^3P_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{+-}$	$1^3P_{2^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{11}-\psi^{\xi_2\xi_3}_{011}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{+-}$	$1^5P_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\sqrt{\frac{1}{3}}\psi^{\xi_1\xi_2}_{011}\chi^{11}_{21}-\sqrt{\frac{2}{3}}\psi^{\xi_1\xi_2}_{010}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{+-}$	$1^1D_{2^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\psi^{\xi_1}_{022}\chi^{00}_{00}-\sqrt{\frac{1}{2}}\psi^{\xi_2}_{022}\chi^{00}_{00}$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{+-}$	$1^1D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\psi^{\xi_1}_{022}\chi^{00}_{00}-\sqrt{\frac{1}{2}}\psi^{\xi_2}_{022}\chi^{00}_{00}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{+-}$	$1^3D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{2}{6}}\psi^{\xi_1}_{022}\chi^{11}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1}_{021}\chi^{11}_{11}-\sqrt{\frac{2}{6}}\psi^{\xi_2}_{022}\chi^{11}_{10}+\sqrt{\frac{1}{6}}\psi^{\xi_2}_{021}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{+-}$	$1^3D_{2^{+-}(\bar{3}3)_c(\xi_3)}$	$\sqrt{\frac{2}{3}}\psi^{\xi_3}_{022}\chi^{11}_{10}-\sqrt{\frac{1}{3}}\psi^{\xi_3}_{021}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{+-}$	$1^3D_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{2}{6}}\psi^{\xi_1\xi_3}_{022}\chi^{10}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1\xi_3}_{021}\chi^{10}_{11}-\sqrt{\frac{2}{6}}\psi^{\xi_2\xi_3}_{022}\chi^{01}_{10}+\sqrt{\frac{1}{6}}\psi^{\xi_2\xi_3}_{021}\chi^{01}_{11}$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{+-}$	$1^3D_{2^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{2}{6}}\psi^{\xi_1\xi_3}_{022}\chi^{01}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1\xi_3}_{021}\chi^{01}_{11}-\sqrt{\frac{2}{6}}\psi^{\xi_2\xi_3}_{022}\chi^{10}_{10}+\sqrt{\frac{1}{6}}\psi^{\xi_2\xi_3}_{021}\chi^{10}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{+-}$	$1^3D_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\sqrt{\frac{2}{3}}\psi^{\xi_1\xi_2}_{022}\chi^{11}_{10}-\sqrt{\frac{1}{3}}\psi^{\xi_1\xi_2}_{021}\chi^{11}_{11}$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{+-}$	$1^5D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{2}{14}}\psi^{\xi_1}_{022}\chi^{11}_{20}-\sqrt{\frac{3}{14}}\psi^{\xi_1}_{021}\chi^{11}_{21}+\sqrt{\frac{2}{14}}\psi^{\xi_1}_{020}\chi^{11}_{22}-\sqrt{\frac{2}{14}}\psi^{\xi_2}_{022}\chi^{11}_{20}+\sqrt{\frac{3}{14}}\psi^{\xi_2}_{021}\chi^{11}_{21}-\sqrt{\frac{2}{14}}\psi^{\xi_2}_{020}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$1^5S_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{000}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{++}$	$1^3P_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{10}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{++}$	$1^3P_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{011}\chi^{01}_{11}+\psi^{\xi_2\xi_3}_{011}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$1^3P_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{011}\chi^{11}_{11}$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{++}$	$1^1D_{2^{++}(6\bar{6})_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\psi^{\xi_1}_{022}\chi^{00}_{00}+\sqrt{\frac{1}{2}}\psi^{\xi_2}_{022}\chi^{00}_{00}$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{++}$	$1^1D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\psi^{\xi_1}_{022}\chi^{00}_{00}+\sqrt{\frac{1}{2}}\psi^{\xi_2}_{022}\chi^{00}_{00}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$1^1D_{2^{++}(6\bar{6})_c(\xi_3)}$	$\psi^{\xi_3}_{022}\chi^{00}_{00}$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{++}$	$1^1D_{2^{++}(\bar{3}3)_c(\xi_3)}$	$\psi^{\xi_3}_{022}\chi^{00}_{00}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$1^1D_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{022}\chi^{00}_{00}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$1^1D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{022}\chi^{11}_{00}$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{++}$	$1^3D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{2}{6}}\psi^{\xi_1}_{022}\chi^{11}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1}_{021}\chi^{11}_{11}+\sqrt{\frac{2}{6}}\psi^{\xi_2}_{022}\chi^{11}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_2}_{021}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$1^3D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{2}{6}}\psi^{\xi_1\xi_3}_{022}\chi^{10}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1\xi_3}_{021}\chi^{10}_{11}+\sqrt{\frac{2}{6}}\psi^{\xi_2\xi_3}_{022}\chi^{01}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_2\xi_3}_{021}\chi^{01}_{11}$	$\|6\bar{6}\rangle^c$
$J^{PC}=2^{++}$	$1^3D_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{2}{6}}\psi^{\xi_1\xi_3}_{022}\chi^{01}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_1\xi_3}_{021}\chi^{01}_{11}+\sqrt{\frac{2}{6}}\psi^{\xi_2\xi_3}_{022}\chi^{10}_{10}-\sqrt{\frac{1}{6}}\psi^{\xi_2\xi_3}_{021}\chi^{10}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$1^5D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{2}{14}}\psi^{\xi_1}_{022}\chi^{11}_{20}-\sqrt{\frac{3}{14}}\psi^{\xi_1}_{021}\chi^{11}_{21}+\sqrt{\frac{2}{14}}\psi^{\xi_1}_{020}\chi^{11}_{22}+\sqrt{\frac{2}{14}}\psi^{\xi_2}_{022}\chi^{11}_{20}-\sqrt{\frac{3}{14}}\psi^{\xi_2}_{021}\chi^{11}_{21}+\sqrt{\frac{2}{14}}\psi^{\xi_2}_{020}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$1^5D_{2^{++}(\bar{3}3)_c(\xi_3)}$	$\sqrt{\frac{2}{7}}\psi^{\xi_3}_{022}\chi^{11}_{20}-\sqrt{\frac{3}{7}}\psi^{\xi_3}_{021}\chi^{11}_{21}+\sqrt{\frac{2}{7}}\psi^{\xi_3}_{020}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
$J^{PC}=2^{++}$	$1^5D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\sqrt{\frac{2}{7}}\psi^{\xi_1\xi_2}_{022}\chi^{11}_{20}-\sqrt{\frac{3}{7}}\psi^{\xi_1\xi_2}_{021}\chi^{11}_{21}+\sqrt{\frac{2}{7}}\psi^{\xi_1\xi_2}_{020}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$
$J^{PC}=3^{+-}$	$1^5P_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{011}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$
$J^{PC}=3^{+-}$	$1^3D_{3^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{022}\chi^{11}_{11}-\psi^{\xi_2}_{022}\chi^{11}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=3^{+-}$	$1^3D_{3^{+-}(\bar{3}3)_c(\xi_3)}$	$\psi^{\xi_3}_{022}\chi^{11}_{11}$	$\|\bar{3}3\rangle^c$
$J^{PC}=3^{+-}$	$1^3D_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{022}\chi^{10}_{11}-\psi^{\xi_2\xi_3}_{022}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=3^{+-}$	$1^3D_{3^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{022}\chi^{01}_{11}-\psi^{\xi_2\xi_3}_{022}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=3^{+-}$	$1^3D_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{022}\chi^{11}_{11}$	$\|6\bar{6}\rangle^c$
$J^{PC}=3^{+-}$	$1^5D_{3^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\frac{1}{2}\left(\psi^{\xi_1}_{022}\chi^{11}_{21}-\psi^{\xi_1}_{021}\chi^{11}_{22}-\psi^{\xi_2}_{022}\chi^{11}_{21}+\psi^{\xi_2}_{021}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=3^{++}$	$1^3D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{022}\chi^{11}_{11}+\psi^{\xi_2}_{022}\chi^{11}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=3^{++}$	$1^3D_{3^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{022}\chi^{10}_{11}+\psi^{\xi_2\xi_3}_{022}\chi^{01}_{11}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=3^{++}$	$1^3D_{3^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_3}_{022}\chi^{01}_{11}+\psi^{\xi_2\xi_3}_{022}\chi^{10}_{11}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=3^{++}$	$1^5D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\frac{1}{2}\left(\psi^{\xi_1}_{022}\chi^{11}_{21}-\psi^{\xi_1}_{021}\chi^{11}_{22}+\psi^{\xi_2}_{022}\chi^{11}_{21}-\psi^{\xi_2}_{021}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=3^{++}$	$1^5D_{3^{++}(\bar{3}3)_c(\xi_3)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_3}_{022}\chi^{11}_{21}-\psi^{\xi_3}_{021}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=3^{++}$	$1^5D_{3^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1\xi_2}_{022}\chi^{11}_{21}-\psi^{\xi_1\xi_2}_{021}\chi^{11}_{22}\right)$	$\|6\bar{6}\rangle^c$
$J^{PC}=4^{+-}$	$1^5D_{4^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{022}\chi^{11}_{22}-\psi^{\xi_2}_{022}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=4^{++}$	$1^5D_{4^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\sqrt{\frac{1}{2}}\left(\psi^{\xi_1}_{022}\chi^{11}_{22}+\psi^{\xi_2}_{022}\chi^{11}_{22}\right)$	$\|\bar{3}3\rangle^c$
$J^{PC}=4^{++}$	$1^5D_{4^{++}(\bar{3}3)_c(\xi_3)}$	$\psi^{\xi_3}_{022}\chi^{11}_{22}$	$\|\bar{3}3\rangle^c$
$J^{PC}=4^{++}$	$1^5D_{4^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	$\psi^{\xi_1\xi_2}_{022}\chi^{11}_{22}$	$\|6\bar{6}\rangle^c$

TABLE VI: Predicted mass spectra for the $cc\bar{c}\bar{c}$ systems up to the $1S$-wave states.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{++}	$1^1S_{0^{++}(6\bar{6})_c}$ $1^1S_{0^{++}(\bar{3}3)_c}$	$\begin{pmatrix} 6518 & 45 \\ 45 & 6487 \end{pmatrix}$	$\begin{pmatrix} 6455 \\ 6550 \end{pmatrix}$	$\begin{pmatrix} (0.58 & -0.81) \\ (-0.81 & -0.58) \end{pmatrix}$
1^{+-}	$1^3S_{1^{+-}(\bar{3}3)_c}$	$\begin{pmatrix} 6500 \end{pmatrix}$	6500	1
2^{++}	$1^5S_{2^{++}(\bar{3}3)_c}$	$\begin{pmatrix} 6524 \end{pmatrix}$	6524	1

TABLE VII: Predicted mass spectra for the $cc\bar{c}\bar{c}$ systems up to the $2S$-wave states.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{+-}	$2^1S_{0^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$ $2^1S_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\begin{pmatrix} 7008 & -8 \\ -8 & 7005 \end{pmatrix}$	$\begin{pmatrix} 6998 \\ 7015 \end{pmatrix}$	$\begin{pmatrix} (-0.63 & -0.78) \\ (-0.78 & 0.63) \end{pmatrix}$
0^{++}	$2^1S_{0^{++}(6\bar{6})_c(\xi_1,\xi_2)}$ $2^1S_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$ $2^1S_{0^{++}(6\bar{6})_c(\xi_3)}$ $2^1S_{0^{++}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6954 & -19 & 93 & -8 \\ -19 & 7000 & -4 & -33 \\ 93 & -4 & 7183 & -12 \\ -8 & -33 & -12 & 6930 \end{pmatrix}$	$\begin{pmatrix} 6908 \\ 6927 \\ 7015 \\ 7217 \end{pmatrix}$	$\begin{pmatrix} (-0.62 & 0.69 & 0.13 & -0.34) \\ (-0.36 & -0.13 & -0.92 & 0.04) \\ (0.18 & -0.28 & -0.07 & -0.94) \\ (-0.67 & -0.65 & 0.35 & 0.04) \end{pmatrix}$
1^{+-}	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$ $2^3S_{1^{+-}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 7009 & 0 \\ 0 & 6934 \end{pmatrix}$	$\begin{pmatrix} 7009 \\ 6934 \end{pmatrix}$	$\begin{pmatrix} (1 & 0) \\ (0 & 1) \end{pmatrix}$
1^{++}	$2^3S_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\begin{pmatrix} 7006 \end{pmatrix}$	7006	1
2^{+-}	$2^5S_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\begin{pmatrix} 7017 \end{pmatrix}$	7017	1
2^{++}	$2^5S_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$ $2^5S_{2^{++}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 7018 & -29 \\ -29 & 6942 \end{pmatrix}$	$\begin{pmatrix} 7028 \\ 6932 \end{pmatrix}$	$\begin{pmatrix} (-0.95 & 0.32) \\ (0.32 & -0.95) \end{pmatrix}$

TABLE VIII: Predicted masses for the P-wave $cc\bar{c}\bar{c}$ states.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{--}	$^3P_{0^{--}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{0^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\begin{pmatrix} 6751 & -132 \\ -132 & 6827 \end{pmatrix}$	$\begin{pmatrix} 6651 \\ 6926 \end{pmatrix}$	$\begin{pmatrix} \begin{pmatrix} -0.7985 & -0.6020 \end{pmatrix} \\ \begin{pmatrix} -0.6020 & 0.7985 \end{pmatrix} \end{pmatrix}$
0^{-+}	$^3P_{0^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{0^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$ $^3P_{0^{-+}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6746 & 88 & 37 \\ 88 & 6825 & 18 \\ 37 & 18 & 6750 \end{pmatrix}$	$\begin{pmatrix} 6681 \\ 6749 \\ 6891 \end{pmatrix}$	$\begin{pmatrix} \begin{pmatrix} 0.82 & -0.47 & -0.32 \end{pmatrix} \\ \begin{pmatrix} -0.14 & 0.38 & 0.91 \end{pmatrix} \\ \begin{pmatrix} 0.55 & 0.80 & 0.25 \end{pmatrix} \end{pmatrix}$
1^{--}	$^3P_{1^{--}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{1^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$ $^5P_{1^{--}(\bar{3}3)_c(\xi_3)}$ $^1P_{1^{--}(\bar{3}3)_c(\xi_3)}$ $^1P_{1^{--}(6\bar{6})_c(\xi_3)}$	$\begin{pmatrix} 6733 & 132 & -29 & -16 & 31 \\ 132 & 6827 & -14 & -7 & 26 \\ -29 & -14 & 6754 & -3 & 10 \\ -16 & -7 & -3 & 6770 & -19 \\ 31 & 26 & 10 & -19 & 6968 \end{pmatrix}$	$\begin{pmatrix} 6636 \\ 6750 \\ 6768 \\ 6904 \\ 6993 \end{pmatrix}$	$\begin{pmatrix} \begin{pmatrix} 0.82 & -0.55 & 0.12 & 0.06 & -0.03 \end{pmatrix} \\ \begin{pmatrix} 0.02 & -0.24 & -0.96 & -0.16 & 0.06 \end{pmatrix} \\ \begin{pmatrix} -0.01 & 0.05 & -0.17 & 0.98 & 0.10 \end{pmatrix} \\ \begin{pmatrix} -0.48 & -0.69 & 0.19 & 0.02 & 0.50 \end{pmatrix} \\ \begin{pmatrix} 0.31 & 0.39 & -0.02 & -0.11 & 0.86 \end{pmatrix} \end{pmatrix}$
1^{-+}	$^3P_{1^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{1^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$ $^3P_{1^{-+}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6751 & -108 & 9 \\ -108 & 6834 & -4 \\ 9 & -4 & 6769 \end{pmatrix}$	$\begin{pmatrix} 6676 \\ 6769 \\ 6908 \end{pmatrix}$	$\begin{pmatrix} \begin{pmatrix} 0.82 & 0.56 & -0.05 \end{pmatrix} \\ \begin{pmatrix} -0.01 & -0.08 & -1.00 \end{pmatrix} \\ \begin{pmatrix} -0.57 & 0.82 & -0.06 \end{pmatrix} \end{pmatrix}$
2^{--}	$^3P_{2^{--}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{2^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$ $^5P_{2^{--}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6746 & -155 & -18 \\ -155 & 6837 & 9 \\ -18 & 9 & 6781 \end{pmatrix}$	$\begin{pmatrix} 6630 \\ 6780 \\ 6955 \end{pmatrix}$	$\begin{pmatrix} \begin{pmatrix} 0.80 & 0.59 & 0.06 \end{pmatrix} \\ \begin{pmatrix} -0.01 & 0.12 & -1.00 \end{pmatrix} \\ \begin{pmatrix} -0.60 & 0.80 & 0.10 \end{pmatrix} \end{pmatrix}$
2^{-+}	$^3P_{2^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$ $^3P_{2^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$ $^3P_{2^{-+}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6754 & 123 & 12 \\ 123 & 6841 & 6 \\ 12 & 6 & 6783 \end{pmatrix}$	$\begin{pmatrix} 6667 \\ 6783 \\ 6928 \end{pmatrix}$	$\begin{pmatrix} \begin{pmatrix} 0.82 & -0.57 & -0.06 \end{pmatrix} \\ \begin{pmatrix} 0.00 & 0.10 & -1.00 \end{pmatrix} \\ \begin{pmatrix} 0.58 & 0.81 & 0.08 \end{pmatrix} \end{pmatrix}$
3^{--}	$^5P_{3^{--}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 6801 \end{pmatrix}$	6801	1

TABLE IX: Predicted mass spectra for the $cc\bar{c}\bar{c}$ systems up to the $1D$-wave states.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{+-}	$\begin{pmatrix} {}^3P_{0^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3P_{0^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 6868 & -113 \\ -113 & 6948 \end{pmatrix}$	$\begin{pmatrix} 6788 \\ 7028 \end{pmatrix}$	$\begin{pmatrix} -0.82 & -0.58 \\ -0.58 & 0.82 \end{pmatrix}$
	$\begin{pmatrix} {}^5D_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7054 \end{pmatrix}$	7054	1
0^{++}	$\begin{pmatrix} {}^1S_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 6838 \end{pmatrix}$	6838	1
	$\begin{pmatrix} {}^1S_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 6957 \end{pmatrix}$	6957	1
	$\begin{pmatrix} {}^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3P_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 6857 & 136 \\ 136 & 6944 \end{pmatrix}$	$\begin{pmatrix} 6758 \\ 7043 \end{pmatrix}$	$\begin{pmatrix} -0.81 & 0.59 \\ 0.59 & 0.81 \end{pmatrix}$
	$\begin{pmatrix} {}^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7053 \end{pmatrix}$	7053	1
	$\begin{pmatrix} {}^5D_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ {}^5D_{0^{++}(\bar{3}3)_c(\xi_3)} \\ {}^5D_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7051 & 61 & 6 \\ 61 & 6968 & -128 \\ 6 & -128 & 7013 \end{pmatrix}$	$\begin{pmatrix} 7048 \\ 6848 \\ 7136 \end{pmatrix}$	$\begin{pmatrix} 0.88 & -0.09 & 0.47 \\ -0.25 & 0.76 & 0.6 \\ 0.41 & 0.64 & -0.65 \end{pmatrix}$
1^{+-}	$\begin{pmatrix} {}^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3S_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 7002 & -7 \\ -7 & 7007 \end{pmatrix}$	$\begin{pmatrix} 6997 \\ 7012 \end{pmatrix}$	$\begin{pmatrix} -0.82 & -0.58 \\ -0.58 & 0.82 \end{pmatrix}$
	$\begin{pmatrix} {}^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 6973 \end{pmatrix}$	6973	1
	$\begin{pmatrix} {}^1P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 6871 \end{pmatrix}$	6871	1
	$\begin{pmatrix} {}^1P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7052 \end{pmatrix}$	7052	1
	$\begin{pmatrix} {}^3P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 6867 & -112 \\ -112 & 6946 \end{pmatrix}$	$\begin{pmatrix} 6788 \\ 7025 \end{pmatrix}$	$\begin{pmatrix} -0.82 & -0.58 \\ -0.58 & 0.82 \end{pmatrix}$
	$\begin{pmatrix} {}^5P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7069 \end{pmatrix}$	7069	1
	$\begin{pmatrix} {}^3D_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7070 \end{pmatrix}$	7070	1
	$\begin{pmatrix} {}^3D_{1^{+-}(\bar{3}3)_c(\xi_3)} \\ {}^3D_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 6978 & -142 \\ -142 & 7008 \end{pmatrix}$	$\begin{pmatrix} 6850 \\ 7136 \end{pmatrix}$	$\begin{pmatrix} -0.74 & -0.67 \\ -0.67 & 0.74 \end{pmatrix}$
	$\begin{pmatrix} {}^3D_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3D_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 7092 & 93 \\ 93 & 7026 \end{pmatrix}$	$\begin{pmatrix} 7158 \\ 6960 \end{pmatrix}$	$\begin{pmatrix} -0.82 & -0.58 \\ 0.58 & -0.82 \end{pmatrix}$
	$\begin{pmatrix} {}^5D_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7064 \end{pmatrix}$	7064	1
1^{++}	$\begin{pmatrix} {}^3S_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3S_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 6991 & 34 \\ 34 & 7003 \end{pmatrix}$	$\begin{pmatrix} 6962 \\ 7032 \end{pmatrix}$	$\begin{pmatrix} -0.77 & 0.64 \\ 0.64 & 0.77 \end{pmatrix}$
	$\begin{pmatrix} {}^3P_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3P_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 6861 & 140 \\ 140 & 6944 \end{pmatrix}$	$\begin{pmatrix} 6756 \\ 7049 \end{pmatrix}$	$\begin{pmatrix} -0.80 & 0.60 \\ 0.60 & 0.80 \end{pmatrix}$
	$\begin{pmatrix} {}^3P_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7051 \end{pmatrix}$	7051	1
	$\begin{pmatrix} {}^3D_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7062 \end{pmatrix}$	7062	1
	$\begin{pmatrix} {}^3D_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3D_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 7096 & -69 \\ -69 & 7028 \end{pmatrix}$	$\begin{pmatrix} 7139 \\ 6985 \end{pmatrix}$	$\begin{pmatrix} -0.85 & 0.53 \\ -0.53 & -0.85 \end{pmatrix}$
	$\begin{pmatrix} {}^5D_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ {}^5D_{1^{++}(\bar{3}3)_c(\xi_3)} \\ {}^5D_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7059 & 62 & 10 \\ 62 & 6976 & -132 \\ 10 & -132 & 7022 \end{pmatrix}$	$\begin{pmatrix} 7060 \\ 6851 \\ 7146 \end{pmatrix}$	$\begin{pmatrix} 0.89 & -0.06 & 0.46 \\ -0.25 & 0.76 & 0.6 \\ 0.38 & 0.65 & -0.66 \end{pmatrix}$
2^{+-}	$\begin{pmatrix} {}^3P_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3P_{2^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 6873 & -121 \\ -121 & 6959 \end{pmatrix}$	$\begin{pmatrix} 6788 \\ 7044 \end{pmatrix}$	$\begin{pmatrix} 0.82 & 0.58 \\ -0.58 & 0.82 \end{pmatrix}$
	$\begin{pmatrix} {}^5P_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7072 \end{pmatrix}$	7072	1
	$\begin{pmatrix} {}^1D_{2^{+-}(6\bar{6})_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 6985 \end{pmatrix}$	6985	1
	$\begin{pmatrix} {}^1D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7087 \end{pmatrix}$	7087	1
	$\begin{pmatrix} {}^3D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7085 \end{pmatrix}$	7085	1
	$\begin{pmatrix} {}^3D_{2^{+-}(\bar{3}3)_c(\xi_3)} \\ {}^3D_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 6985 & -149 \\ -149 & 7028 \end{pmatrix}$	$\begin{pmatrix} 7157 \\ 6856 \end{pmatrix}$	$\begin{pmatrix} -0.65 & 0.76 \\ 0.76 & 0.65 \end{pmatrix}$
	$\begin{pmatrix} {}^3D_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3D_{2^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 7106 & 86 \\ 86 & 7045 \end{pmatrix}$	$\begin{pmatrix} 7167 \\ 6984 \end{pmatrix}$	$\begin{pmatrix} 0.82 & 0.58 \\ -0.58 & 0.82 \end{pmatrix}$
	$\begin{pmatrix} {}^5D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7082 \end{pmatrix}$	7082	1

TABLE X: Predicted mass spectra for the $cc\bar{c}\bar{c}$ systems up to the $1D$-wave states.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
2^{++}	$\begin{pmatrix} 1^5S_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7004 \end{pmatrix}$	7004	1
	$\begin{pmatrix} 1^3P_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ 1^3P_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 6864 & 145 \\ 145 & 6955 \end{pmatrix}$	$\begin{pmatrix} 6758 \\ 7061 \end{pmatrix}$	$\begin{pmatrix} -0.81 & 0.59 \\ 0.59 & 0.81 \end{pmatrix}$
	$\begin{pmatrix} 1^3P_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7073 \end{pmatrix}$	7073	1
	$\begin{pmatrix} 1^1D_{2^{++}(6\bar{6})_c(\xi_1,\xi_2)} \\ 1^1D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ 1^1D_{2^{++}(6\bar{6})_c(\xi_3)} \\ 1^1D_{2^{++}(\bar{3}3)_c(\xi_3)} \\ 1^1D_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)} \\ 1^1D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 6955 & -19 & 174 & 5 & 25 & 3 \\ -19 & 7073 & 5 & 72 & 1 & 28 \\ 174 & 5 & 6964 & -21 & -147 & -6 \\ 5 & 72 & -21 & 6986 & -2 & -153 \\ 25 & 1 & -147 & -2 & 6859 & -20 \\ 3 & 28 & -6 & -153 & -20 & 7018 \end{pmatrix}$	$\begin{pmatrix} 7151 \\ 7086 \\ 6685 \\ 6832 \\ 6924 \\ 7178 \end{pmatrix}$	$\begin{pmatrix} -0.45 & -0.17 & -0.55 & -0.45 & 0.21 & 0.46 \\ 0.03 & -0.9 & -0.08 & 0.02 & 0.09 & -0.42 \\ 0.46 & 0.06 & -0.62 & -0.13 & -0.6 & -0.12 \\ -0.09 & 0.28 & 0.1 & -0.72 & 0.13 & -0.61 \\ -0.65 & -0.08 & 0.21 & 0.01 & -0.72 & -0.07 \\ -0.38 & 0.28 & -0.5 & 0.51 & 0.23 & -0.46 \end{pmatrix}$
	$\begin{pmatrix} 1^3D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7073 \end{pmatrix}$	7073	1
	$\begin{pmatrix} 1^3D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ 1^3D_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 7105 & -74 \\ -74 & 7045 \end{pmatrix}$	$\begin{pmatrix} 7155 \\ 6995 \end{pmatrix}$	$\begin{pmatrix} -0.83 & 0.56 \\ 0.56 & 0.83 \end{pmatrix}$
	$\begin{pmatrix} 1^5D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ 1^5D_{2^{++}(\bar{3}3)_c(\xi_3)} \\ 1^5D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7073 & 65 & 17 \\ 65 & 6989 & -138 \\ 17 & -138 & 7040 \end{pmatrix}$	$\begin{pmatrix} 7080 \\ 6857 \\ 7165 \end{pmatrix}$	$\begin{pmatrix} -0.90 & 0.02 & -0.43 \\ -0.27 & 0.76 & 0.59 \\ -0.34 & -0.65 & 0.68 \end{pmatrix}$
3^{+-}	$\begin{pmatrix} 1^5P_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7102 \end{pmatrix}$	7102	1
	$\begin{pmatrix} 1^3D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7103 \end{pmatrix}$	7103	1
	$\begin{pmatrix} 1^3D_{3^{+-}(\bar{3}3)_c(\xi_3)} \\ 1^3D_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7002 & -154 \\ -154 & 7043 \end{pmatrix}$	$\begin{pmatrix} 6867 \\ 7178 \end{pmatrix}$	$\begin{pmatrix} 0.75 & 0.66 \\ -0.66 & 0.75 \end{pmatrix}$
	$\begin{pmatrix} 1^3D_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ 1^3D_{3^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 7124 & 87 \\ 87 & 7062 \end{pmatrix}$	$\begin{pmatrix} 7185 \\ 7001 \end{pmatrix}$	$\begin{pmatrix} -0.82 & -0.58 \\ 0.58 & -0.82 \end{pmatrix}$
	$\begin{pmatrix} 1^5D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7103 \end{pmatrix}$	7103	1
3^{++}	$\begin{pmatrix} 1^3D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7089 \end{pmatrix}$	7089	1
	$\begin{pmatrix} 1^3D_{3^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ 1^3D_{3^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 7126 & -69 \\ -69 & 7063 \end{pmatrix}$	$\begin{pmatrix} 7170 \\ 7019 \end{pmatrix}$	$\begin{pmatrix} 0.84 & -0.54 \\ 0.54 & 0.84 \end{pmatrix}$
	$\begin{pmatrix} 1^5D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ 1^5D_{3^{++}(\bar{3}3)_c(\xi_3)} \\ 1^5D_{3^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7091 & 69 & 25 \\ 69 & 7005 & -146 \\ 25 & -146 & 7060 \end{pmatrix}$	$\begin{pmatrix} 7105 \\ 6863 \\ 7189 \end{pmatrix}$	$\begin{pmatrix} 0.91 & 0.03 & 0.41 \\ -0.29 & 0.75 & 0.59 \\ -0.29 & -0.66 & 0.69 \end{pmatrix}$
4^{+-}	$\begin{pmatrix} 1^5D_{4^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7122 \end{pmatrix}$	7122	1
4^{++}	$\begin{pmatrix} 1^5D_{4^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ 1^5D_{4^{++}(\bar{3}3)_c(\xi_3)} \\ 1^5D_{4^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7108 & 72 & 31 \\ 72 & 7020 & -153 \\ 31 & -153 & 7079 \end{pmatrix}$	$\begin{pmatrix} 7126 \\ 6870 \\ 7211 \end{pmatrix}$	$\begin{pmatrix} 0.92 & 0.07 & 0.39 \\ -0.3 & 0.75 & 0.59 \\ 0.25 & 0.66 & -0.71 \end{pmatrix}$

TABLE XI: Predicted mass spectra for the $cc\bar{c}\bar{c}$ systems up to the $1S$-wave states.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{++}	$\begin{matrix} 1^1S_{0^{++}(6\bar{6})_c} \\ 1^1S_{0^{++}(\bar{3}3)_c} \end{matrix}$	$\begin{pmatrix} 19338 & -23 \\ -23 & 19322 \end{pmatrix}$	$\begin{pmatrix} 19306 \\ 19355 \end{pmatrix}$	$\begin{pmatrix} (\ 0.58 & -0.81\ ) \\ (\ -0.81 & -0.58\ ) \end{pmatrix}$
1^{+-}	$1^3S_{1^{+-}(\bar{3}3)_c}$	$\begin{pmatrix} 19329 \end{pmatrix}$	19329	1
2^{++}	$1^5S_{2^{++}(\bar{3}3)_c}$	$\begin{pmatrix} 19341 \end{pmatrix}$	19341	1

TABLE XII: Predicted mass spectra for the $bb\bar{b}\bar{b}$ systems up to the $2S$-wave states.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{+-}	$2^1S_{0^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$ $2^1S_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\begin{pmatrix} 19840 & 3 \\ 3 & 19790 \end{pmatrix}$	$\begin{pmatrix} 19840 \\ 19790 \end{pmatrix}$	$\begin{pmatrix} (-1.0000 & -0.0500) \\ (0.0500 & -1.0000) \end{pmatrix}$
0^{++}	$2^1S_{0^{++}(6\bar{6})_c(\xi_1,\xi_2)}$ $2^1S_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$ $2^1S_{0^{++}(6\bar{6})_c(\xi_3)}$ $2^1S_{0^{++}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 19770 & -7 & 32 & -3 \\ -7 & 19797 & -2 & -28 \\ 32 & -2 & 19972 & -4 \\ -3 & -28 & -4 & 19733 \end{pmatrix}$	$\begin{pmatrix} 19765 \\ 19809 \\ 19977 \\ 19722 \end{pmatrix}$	$\begin{pmatrix} (-0.97 & -0.07 & 0.15 & 0.15) \\ (0.12 & -0.93 & -0.02 & 0.35) \\ (-0.16 & 0.01 & -0.99 & 0.02) \\ (0.12 & 0.36 & 0 & 0.93) \end{pmatrix}$
1^{+-}	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$ $2^3S_{1^{+-}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 19792 & 0 \\ 0 & 19735 \end{pmatrix}$	$\begin{pmatrix} 19792 \\ 19735 \end{pmatrix}$	$\begin{pmatrix} (1 & 0) \\ (0 & 1) \end{pmatrix}$
1^{++}	$2^3S_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	(19800)	19800	1
2^{+-}	$2^5S_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	(19795)	19795	1
2^{++}	$2^5S_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$ $2^5S_{2^{++}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 19804 & -28 \\ -28 & 19738 \end{pmatrix}$	$\begin{pmatrix} 19815 \\ 19727 \end{pmatrix}$	$\begin{pmatrix} (-0.94 & 0.35) \\ (0.35 & -0.94) \end{pmatrix}$

TABLE XIII: Predicted masses for the P-wave $cc\bar{c}\bar{c}$ states.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{--}	$1^3P_{0^{--}(6\bar{6})_c(\xi_1,\xi_2)}$ $1^3P_{0^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	$\begin{pmatrix} 19579 & 129 \\ 129 & 19662 \end{pmatrix}$	$\begin{pmatrix} 19485 \\ 19756 \end{pmatrix}$	$\begin{pmatrix} (-0.81 & 0.59) \\ (0.59 & 0.81) \end{pmatrix}$
0^{-+}	$1^3P_{0^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$ $1^3P_{0^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$ $1^3P_{0^{-+}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 19577 & -110 & 15 \\ -110 & 19662 & -7 \\ 15 & -7 & 19596 \end{pmatrix}$	$\begin{pmatrix} 19500 \\ 19595 \\ 19739 \end{pmatrix}$	$\begin{pmatrix} (0.82 & 0.56 & -0.09) \\ (0.02 & 0.13 & 0.99) \\ (0.57 & -0.82 & 0.10) \end{pmatrix}$
1^{--}	$1^3P_{1^{--}(6\bar{6})_c(\xi_1,\xi_2)}$ $1^3P_{1^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$ $1^5P_{1^{--}(\bar{3}3)_c(\xi_3)}$ $1^1P_{1^{--}(\bar{3}3)_c(\xi_3)}$ $1^1P_{1^{--}(6\bar{6})_c(\xi_3)}$	$\begin{pmatrix} 19571 & -129 & 12 & -12 & 7 \\ -129 & 19662 & -5 & 10 & -3 \\ 12 & -5 & 19598 & 4 & -1 \\ -12 & 10 & 4 & 19789 & -8 \\ 7 & -3 & -1 & -8 & 19604 \end{pmatrix}$	$\begin{pmatrix} 19479 \\ 19597 \\ 19603 \\ 19749 \\ 19795 \end{pmatrix}$	$\begin{pmatrix} (-0.82 & -0.57 & 0.06 & -0.01 & 0.03) \\ (0.00 & 0.10 & 0.98 & -0.02 & 0.18) \\ (0.00 & 0.03 & -0.18 & 0.04 & 0.98) \\ (0.53 & -0.76 & 0.08 & 0.36 & 0.02) \\ (0.22 & -0.28 & 0.00 & -0.93 & 0.05) \end{pmatrix}$
1^{-+}	$1^3P_{1^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$ $1^3P_{1^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$ $1^3P_{1^{-+}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 19579 & -118 & -4 \\ -118 & 19665 & 2 \\ -4 & 2 & 19604 \end{pmatrix}$	$\begin{pmatrix} 19496 \\ 19603 \\ 19748 \end{pmatrix}$	$\begin{pmatrix} (0.82 & 0.57 & 0.02) \\ (0.00 & 0.03 & -1.00) \\ (-0.57 & 0.82 & 0.02) \end{pmatrix}$
2^{--}	$1^3P_{2^{--}(6\bar{6})_c(\xi_1,\xi_2)}$ $1^3P_{2^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$ $1^5P_{2^{--}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 19576 & 138 & 8 \\ 138 & 19667 & 4 \\ 8 & 4 & 19609 \end{pmatrix}$	$\begin{pmatrix} 19476 \\ 19608 \\ 19767 \end{pmatrix}$	$\begin{pmatrix} (0.81 & -0.59 & -0.03) \\ (0.00 & 0.06 & -1.00) \\ (0.59 & 0.81 & 0.05) \end{pmatrix}$
2^{-+}	$1^3P_{2^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$ $1^3P_{2^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$ $1^3P_{2^{-+}(\bar{3}3)_c(\xi_3)}$	$\begin{pmatrix} 19580 & -124 & 5 \\ -124 & 19668 & -2 \\ 5 & -2 & 19609 \end{pmatrix}$	$\begin{pmatrix} 19492 \\ 19609 \\ 19756 \end{pmatrix}$	$\begin{pmatrix} (0.82 & 0.58 & -0.02) \\ (0.00 & -0.04 & -1.00) \\ (-0.58 & 0.82 & -0.03) \end{pmatrix}$
3^{--}	$1^5P_{3^{--}(\bar{3}3)_c(\xi_3)}$	(19587)	19587	1

TABLE XIV: Predicted mass spectra for the $bb\bar{b}\bar{b}$ systems up to the $1D$-wave states.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
0^{+-}	$\begin{pmatrix} {}^3P_{0^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3P_{0^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19693 & -116 \\ -116 & 19775 \end{pmatrix}$	$\begin{pmatrix} 19611 \\ 19857 \end{pmatrix}$	$\begin{pmatrix} -0.82 & -0.58 \\ 0.58 & -0.82 \end{pmatrix}$
0^{+-}	$\begin{pmatrix} {}^5D_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19884 \end{pmatrix}$	19884	1
0^{++}	$\begin{pmatrix} {}^1S_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19677 \end{pmatrix}$	19677	1
0^{++}	$\begin{pmatrix} {}^1S_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19796 \end{pmatrix}$	19796	1
0^{++}	$\begin{pmatrix} {}^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3P_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19688 & 125 \\ 125 & 19773 \end{pmatrix}$	$\begin{pmatrix} 19598 \\ 19863 \end{pmatrix}$	$\begin{pmatrix} -0.81 & 0.58 \\ 0.58 & 0.81 \end{pmatrix}$
0^{++}	$\begin{pmatrix} {}^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19884 \end{pmatrix}$	19884	1
0^{++}	$\begin{pmatrix} {}^5D_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ {}^5D_{0^{++}(\bar{3}3)_c(\xi_3)} \\ {}^5D_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19873 & 59 & 22 \\ 59 & 19800 & -126 \\ 22 & -126 & 19847 \end{pmatrix}$	$\begin{pmatrix} 19885 \\ 19677 \\ 19958 \end{pmatrix}$	$\begin{pmatrix} 0.91 & 0.04 & 0.4 \\ -0.29 & 0.75 & 0.59 \\ 0.28 & 0.66 & -0.7 \end{pmatrix}$
1^{+-}	$\begin{pmatrix} {}^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3S_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19812 & -24 \\ -24 & 19828 \end{pmatrix}$	$\begin{pmatrix} 19795 \\ 19845 \end{pmatrix}$	$\begin{pmatrix} 0.81 & 0.58 \\ 0.58 & -0.81 \end{pmatrix}$
1^{+-}	$\begin{pmatrix} {}^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19802 \end{pmatrix}$	19802	1
1^{+-}	$\begin{pmatrix} {}^1P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19711 \end{pmatrix}$	19711	1
1^{+-}	$\begin{pmatrix} {}^1P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_2)} \\ {}^1P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19883 \end{pmatrix}$	19883	1
1^{+-}	$\begin{pmatrix} {}^3P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19692 & -116 \\ -116 & 19774 \end{pmatrix}$	$\begin{pmatrix} 19610 \\ 19856 \end{pmatrix}$	$\begin{pmatrix} -0.82 & -0.58 \\ -0.58 & 0.82 \end{pmatrix}$
1^{+-}	$\begin{pmatrix} {}^5P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19890 \end{pmatrix}$	19890	1
1^{+-}	$\begin{pmatrix} {}^3D_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19889 \end{pmatrix}$	19889	1
1^{+-}	$\begin{pmatrix} {}^3D_{1^{+-}(\bar{3}3)_c(\xi_3)} \\ {}^3D_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19803 & -131 \\ -131 & 19845 \end{pmatrix}$	$\begin{pmatrix} 19691 \\ 19957 \end{pmatrix}$	$\begin{pmatrix} -0.76 & -0.65 \\ -0.65 & 0.76 \end{pmatrix}$
1^{+-}	$\begin{pmatrix} {}^3D_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3D_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19906 & 70 \\ 70 & 19856 \end{pmatrix}$	$\begin{pmatrix} 19955 \\ 19807 \end{pmatrix}$	$\begin{pmatrix} -0.82 & -0.58 \\ 0.58 & -0.82 \end{pmatrix}$
1^{+-}	$\begin{pmatrix} {}^5D_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19887 \end{pmatrix}$	19887	1
1^{++}	$\begin{pmatrix} {}^3S_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3S_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19807 & 34 \\ 34 & 19827 \end{pmatrix}$	$\begin{pmatrix} 19782 \\ 19852 \end{pmatrix}$	$\begin{pmatrix} -0.8 & 0.6 \\ 0.6 & 0.8 \end{pmatrix}$
1^{++}	$\begin{pmatrix} {}^3P_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3P_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19690 & 127 \\ 127 & 19773 \end{pmatrix}$	$\begin{pmatrix} 19598 \\ 19865 \end{pmatrix}$	$\begin{pmatrix} -0.81 & 0.59 \\ 0.59 & 0.81 \end{pmatrix}$
1^{++}	$\begin{pmatrix} {}^3P_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19883 \end{pmatrix}$	19883	1
1^{++}	$\begin{pmatrix} {}^3D_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19877 \end{pmatrix}$	19877	1
1^{++}	$\begin{pmatrix} {}^3D_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3D_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19907 & -62 \\ -62 & 19856 \end{pmatrix}$	$\begin{pmatrix} 19949 \\ 19814 \end{pmatrix}$	$\begin{pmatrix} -0.83 & 0.55 \\ 0.56 & 0.83 \end{pmatrix}$
1^{++}	$\begin{pmatrix} {}^5D_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ {}^5D_{1^{++}(\bar{3}3)_c(\xi_3)} \\ {}^5D_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19876 & 60 & 23 \\ 60 & 19802 & -127 \\ 23 & -127 & 19850 \end{pmatrix}$	$\begin{pmatrix} 19889 \\ 19678 \\ 19961 \end{pmatrix}$	$\begin{pmatrix} 0.91 & 0.04 & 0.4 \\ -0.3 & 0.75 & 0.59 \\ 0.28 & 0.66 & -0.7 \end{pmatrix}$
2^{+-}	$\begin{pmatrix} {}^3P_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3P_{2^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19695 & -119 \\ -119 & 19779 \end{pmatrix}$	$\begin{pmatrix} 19611 \\ 19863 \end{pmatrix}$	$\begin{pmatrix} -0.82 & -0.58 \\ -0.58 & 0.82 \end{pmatrix}$
2^{+-}	$\begin{pmatrix} {}^5P_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19891 \end{pmatrix}$	19891	1
2^{+-}	$\begin{pmatrix} {}^1D_{2^{+-}(6\bar{6})_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19807 \end{pmatrix}$	19807	1
2^{+-}	$\begin{pmatrix} {}^1D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19895 \end{pmatrix}$	19895	1
2^{+-}	$\begin{pmatrix} {}^3D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19894 \end{pmatrix}$	19894	1
2^{+-}	$\begin{pmatrix} {}^3D_{2^{+-}(\bar{3}3)_c(\xi_3)} \\ {}^3D_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19806 & -133 \\ -133 & 19852 \end{pmatrix}$	$\begin{pmatrix} 19694 \\ 19964 \end{pmatrix}$	$\begin{pmatrix} -0.76 & -0.64 \\ -0.64 & 0.76 \end{pmatrix}$
2^{+-}	$\begin{pmatrix} {}^3D_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ {}^3D_{2^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19910 & 68 \\ 68 & 19863 \end{pmatrix}$	$\begin{pmatrix} 19958 \\ 19815 \end{pmatrix}$	$\begin{pmatrix} -0.81 & -0.58 \\ 0.58 & -0.81 \end{pmatrix}$
2^{+-}	$\begin{pmatrix} {}^5D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19893 \end{pmatrix}$	19893	1

TABLE XV: Predicted mass spectra for the $bb\bar{b}\bar{b}$ systems up to the $1D$-wave states.

$J^{P(C)}$	Configuration	$\langle H\rangle$ (MeV)	Mass (MeV)	Eigenvector
2^{++}	$\begin{pmatrix} 1^5S_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19814 \end{pmatrix}$	19814	1
2^{++}	$\begin{pmatrix} 1^3P_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ 1^3P_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19691 & 129 \\ 129 & 19777 \end{pmatrix}$	$\begin{pmatrix} 19598 \\ 19870 \end{pmatrix}$	$\begin{pmatrix} -0.81 & 0.58 \\ 0.58 & 0.81 \end{pmatrix}$
2^{++}	$\begin{pmatrix} 1^3P_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19891 \end{pmatrix}$	19891	1
2^{++}	$\begin{pmatrix} 1^1D_{2^{++}(6\bar{6})_c(\xi_1,\xi_2)} \\ 1^1D_{2^{++}(6\bar{6})_c(\xi_3)} \\ 1^1D_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19773 & 156 & 29 \\ 156 & 19770 & -133 \\ 29 & -133 & 19697 \end{pmatrix}$	$\begin{pmatrix} 19952 \\ 19758 \\ 19530 \end{pmatrix}$	$\begin{pmatrix} -0.59 & -0.74 & 0.32 \\ 0.64 & -0.2 & 0.74 \\ 0.48 & -0.64 & -0.59 \end{pmatrix}$
2^{++}	$\begin{pmatrix} 1^1D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ 1^1D_{2^{++}(\bar{3}3)_c(\xi_3)} \\ 1^1D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19881 & 63 & 30 \\ 63 & 19806 & -135 \\ 30 & -135 & 19848 \end{pmatrix}$	$\begin{pmatrix} 19968 \\ 19669 \\ 19898 \end{pmatrix}$	$\begin{pmatrix} 0.25 & 0.67 & -0.7 \\ -0.3 & 0.74 & 0.61 \\ 0.92 & 0.06 & 0.39 \end{pmatrix}$
2^{++}	$\begin{pmatrix} 1^3D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19881 \end{pmatrix}$	19881	1
2^{++}	$\begin{pmatrix} 1^3D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ 1^3D_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19910 & -63 \\ -63 & 19862 \end{pmatrix}$	$\begin{pmatrix} 19953 \\ 19819 \end{pmatrix}$	$\begin{pmatrix} -0.82 & 0.57 \\ -0.57 & -0.82 \end{pmatrix}$
2^{++}	$\begin{pmatrix} 1^5D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ 1^5D_{2^{++}(\bar{3}3)_c(\xi_3)} \\ 1^5D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19881 & 61 & 26 \\ 61 & 19807 & -129 \\ 26 & -129 & 19856 \end{pmatrix}$	$\begin{pmatrix} 19896 \\ 19680 \\ 19968 \end{pmatrix}$	$\begin{pmatrix} 0.92 & 0.06 & 0.39 \\ -0.3 & 0.75 & 0.59 \\ 0.25 & 0.66 & -0.7 \end{pmatrix}$
3^{+-}	$\begin{pmatrix} 1^5P_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19902 \end{pmatrix}$	19902	1
3^{+-}	$\begin{pmatrix} 1^3D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19901 \end{pmatrix}$	19901	1
3^{+-}	$\begin{pmatrix} 1^3D_{3^{+-}(\bar{3}3)_c(\xi_3)} \\ 1^3D_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19812 & -135 \\ -135 & 19857 \end{pmatrix}$	$\begin{pmatrix} 19698 \\ 19971 \end{pmatrix}$	$\begin{pmatrix} 0.76 & 0.65 \\ -0.65 & 0.76 \end{pmatrix}$
3^{+-}	$\begin{pmatrix} 1^3D_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ 1^3D_{3^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19917 & 68 \\ 68 & 19869 \end{pmatrix}$	$\begin{pmatrix} 19965 \\ 19821 \end{pmatrix}$	$\begin{pmatrix} -0.82 & -0.58 \\ 0.58 & -0.82 \end{pmatrix}$
3^{+-}	$\begin{pmatrix} 1^5D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19901 \end{pmatrix}$	19901	1
3^{++}	$\begin{pmatrix} 1^3D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19887 \end{pmatrix}$	19887	1
3^{++}	$\begin{pmatrix} 1^3D_{3^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \\ 1^3D_{3^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)} \end{pmatrix}$	$\begin{pmatrix} 19917 & -61 \\ -61 & 19869 \end{pmatrix}$	$\begin{pmatrix} 19959 \\ 19827 \end{pmatrix}$	$\begin{pmatrix} 0.83 & -0.56 \\ 0.56 & 0.83 \end{pmatrix}$
3^{++}	$\begin{pmatrix} 1^5D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ 1^5D_{3^{++}(\bar{3}3)_c(\xi_3)} \\ 1^5D_{3^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19887 & 62 & 28 \\ 62 & 19813 & -131 \\ 28 & -131 & 19864 \end{pmatrix}$	$\begin{pmatrix} 19904 \\ 19684 \\ 19976 \end{pmatrix}$	$\begin{pmatrix} 0.92 & 0.08 & 0.38 \\ -0.31 & 0.75 & 0.59 \\ -0.24 & -0.66 & 0.71 \end{pmatrix}$
4^{+-}	$\begin{pmatrix} 1^5D_{4^{+-}(\bar{3}3)_c(\xi_1,\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 7122 \end{pmatrix}$	19908	1
4^{++}	$\begin{pmatrix} 1^5D_{4^{++}(\bar{3}3)_c(\xi_1,\xi_2)} \\ 1^5D_{4^{++}(\bar{3}3)_c(\xi_3)} \\ 1^5D_{4^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)} \end{pmatrix}$	$\begin{pmatrix} 19894 & 63 & 30 \\ 63 & 19819 & -134 \\ 30 & -134 & 19871 \end{pmatrix}$	$\begin{pmatrix} 19912 \\ 19686 \\ 19985 \end{pmatrix}$	$\begin{pmatrix} 0.92 & 0.1 & 0.37 \\ -0.31 & 0.74 & 0.59 \\ -0.22 & -0.66 & 0.72 \end{pmatrix}$

TABLE XVI: The average contributions of each part of the Hamiltonian to the $cc\bar{c}\bar{c}$ configurations. $\langle T\rangle$ stands for the contribution of the kinetic energy term. $\langle V^{Lin}\rangle$ and $\langle V^{Coul}\rangle$ stand for the contributions from the linear confinement potential and Coulomb type potential, respectively. $\langle V^{SS}\rangle$, $\langle V^{T}\rangle$, and $\langle V^{LS}\rangle$ stand for the contributions from the spin-spin interaction term, the tensor potential term, and the spin-orbit interaction term, respectively.

$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$	$\langle V^{T}\rangle$	$\langle V^{LS}\rangle$
0^{+-}	$2^1S_{0^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$	7008	706	899	-540	10		
	$2^1S_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7005	776	924	-629	3		
0^{++}	$2^1S_{0^{++}(6\bar{6})_c(\xi_1,\xi_2)}$	6954	725	883	-598	11		
	$2^1S_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7000	774	919	-622	-4		
	$2^1S_{0^{++}(6\bar{6})_c(\xi_3)}$	7183	757	1010	-522	7		
	$2^1S_{0^{++}(\bar{3}3)_c(\xi_3)}$	6930	761	876	-642	3		
1^{+-}	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7009	773	925	-628	7		
	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_3)}$	6934	745	885	-634	6		
1^{++}	$^3S_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7006	774	920	-622	2		
2^{+-}	$2^5S_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7017	762	932	-624	15		
2^{++}	$2^5S_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7018	753	932	-613	14		
	$2^5S_{2^{++}(\bar{3}3)_c(\xi_3)}$	6942	741	888	-633	14		

TABLE XVII: The average contributions of each part of the Hamiltonian to the $cc\bar{c}\bar{c}$ configurations. $\langle T\rangle$ stands for the contribution of the kinetic energy term. $\langle V^{Lin}\rangle$ and $\langle V^{Coul}\rangle$ stand for the contributions from the linear confinement potential and Coulomb type potential, respectively. $\langle V^{SS}\rangle$, $\langle V^{T}\rangle$, and $\langle V^{LS}\rangle$ stand for the contributions from the spin-spin interaction term, the tensor potential term, and the spin-orbit interaction term, respectively.

$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$	$\langle V^{T}\rangle$	$\langle V^{LS}\rangle$
0^{--}	$1^3P_{0^{--}(6\bar{6})_c(\xi_1,\xi_2)}$	6751	716	778	-686	1.62	12.92	-4.31
	$1^3P_{0^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	6827	741	811	-651	0.62	3.04	-9.11
0^{-+}	$1^3P_{0^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$	6746	727	773	-691	11.59	-1.48	-4.43
	$1^3P_{0^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$	6825	745	808	-653	4.7	-3.07	-9.22
	$1^3P_{0^{-+}(\bar{3}3)_c(\xi_3)}$	6750	765	769	-694	4.22	-6.45	-19.36
1^{--}	$1^3P_{1^{--}(6\bar{6})_c(\xi_1,\xi_2)}$	6733	743	765	-699	1.73	-6.89	-2.3
	$1^3P_{1^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	6827	741	811	-651	0.62	-1.52	-4.55
	$1^5P_{1^{--}(\bar{3}3)_c(\xi_3)}$	6754	761	771	-692	15.62	-4.47	-28.76
	$1^1P_{1^{--}(\bar{3}3)_c(\xi_3)}$	6968	714	886	-578	13.51	0	0
	$1^1P_{1^{--}(6\bar{6})_c(\xi_3)}$	6770	734	784	-679	-1.38	0	0
1^{-+}	$1^3P_{1^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$	6751	720	776	-688	11.45	0.73	-2.18
	$1^3P_{1^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$	6834	732	815	-647	4.63	1.49	-4.46
	$1^3P_{1^{-+}(\bar{3}3)_c(\xi_3)}$	6769	736	783	-680	4.03	3.01	-9.03
2^{--}	$1^3P_{2^{--}(6\bar{6})_c(\xi_1,\xi_2)}$	6751	720	776	-688	11.45	0.73	-2.18
	$1^3P_{2^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	6834	732	815	-647	4.63	1.49	-4.46
	$1^5P_{2^{--}(\bar{3}3)_c(\xi_3)}$	6769	736	783	-680	4.03	3.01	-9.03
2^{-+}	$1^3P_{2^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$	6754	715	779	-685	11.35	-0.14	2.15
	$1^3P_{2^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$	6841	721	821	-642	4.57	-0.29	4.35
	$1^3P_{2^{-+}(\bar{3}3)_c(\xi_3)}$	6783	715	794	-670	3.89	-0.57	8.59
3^{--}	$1^5P_{3^{--}(\bar{3}3)_c(\xi_3)}$	6795	693	803	-663	13.92	-1.12	16.87

TABLE XVIII: The average contributions of each part of the Hamiltonian to the $cc\bar{c}\bar{c}$ configurations. $\langle T\rangle$ stands for the contribution of the kinetic energy term. $\langle V^{Lin}\rangle$ and $\langle V^{Coul}\rangle$ stand for the contributions from the linear confinement potential and Coulomb type potential, respectively. $\langle V^{SS}\rangle$, $\langle V^{T}\rangle$, and $\langle V^{LS}\rangle$ stand for the contributions from the spin-spin interaction term, the tensor potential term, and the spin-orbit interaction term, respectively.

$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$	$\langle V^{T}\rangle$	$\langle V^{LS}\rangle$
	$1^3P_{0^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6868	732	837	-636	6.18	0	-2.28
0^{+-}	$1^3P_{0^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6948	749	876	-601	-2.66	0	-4.73
	$1^5D_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7054	809	924	-572	9.25	-5.91	-43.52
	$1^1S_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$	6838	769	818	-657	-24.14	0	0
	$1^1S_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	6957	788	877	-603	-37.55	0	0
	$1^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6857	745	830	-642	-2.02	-2.35	-2.35
0^{++}	$1^3P_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6944	754	873	-603	-6.08	-0.96	-4.79
	$1^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7053	775	925	-553	-15.43	2.49	-12.47
	$1^5D_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7051	798	927	-577	9.84	-4.46	-35.39
	$1^5D_{0^{++}(\bar{3}3)_c(\xi_3)}$	6968	783	883	-603	10.84	-4.59	-32.12
	$1^5D_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7013	802	902	-585	9.78	-5.96	-41.73
	$1^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7002	739	908	-584	7.19	0	0
	$1^3S_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7007	743	906	-571	-2.36	0	0
	$1^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	6973	768	888	-595	-20.14	0	0
	$1^1P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$	6871	767	834	-637	-23.89	0	0
	$1^1P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7052	776	924	-554	-26.86	0	0
	$1^3P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6867	733	836	-637	6.2	-0.86	-2.58
1^{+-}	$1^3P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6946	753	874	-603	-2.68	-1.79	-5.37
	$1^5P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7069	754	937	-545	7.04	0.6	-16.07
	$1^3D_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7070	783	939	-562	-0.47	-0.76	-20.53
	$1^3D_{1^{+-}(\bar{3}3)_c(\xi_3)}$	6978	767	891	-597	-1.51	1.23	-15.46
	$1^3D_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7092	782	953	-555	1.73	-0.06	-19.86
	$1^3D_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7026	786	912	-575	-4.9	-2.18	-21.88
	$1^3D_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7008	804	901	-586	-18.28	-2.98	-20.89
	$1^5D_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7064	794	933	-566	8.98	-2.86	-35.06
	$1^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6991	747	903	-588	-3.32	0	0
	$1^3S_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7003	746	903	-572	-6.56	0	0
	$1^3P_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6861	739	833	-640	-2	2.03	-2.61
	$1^3P_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6944	755	873	-603	-6.09	-0.6	-5.39
	$1^3P_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7051	779	923	-555	-15.54	-3.14	-9.43
1^{++}	$1^3D_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7062	781	937	-570	-1.23	-0.13	-17.01
	$1^3D_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7096	777	956	-554	2.85	1.81	-19.64
	$1^3D_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7028	784	913	-574	-4.41	-1.4	-21.78
	$1^5D_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7059	786	934	-572	9.62	-2.17	-28.72
	$1^5D_{1^{++}(\bar{3}3)_c(\xi_3)}$	6976	772	889	-599	10.6	-2.24	-26.09
	$1^5D_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7022	787	911	-580	9.49	-2.88	-33.63
	$1^3P_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6873	725	841	-633	6.1	0.17	2.53
	$1^3P_{2^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6959	735	884	-595	-2.57	0.34	5.15
	$1^5P_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7072	751	939	-544	6.99	-4.13	-8.86
	$1^1D_{2^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$	6985	727	895	-575	5.62	0	0
	$1^1D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7087	760	953	-553	-4.84	0	0
2^{+-}	$1^3D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7085	762	952	-554	-0.44	0.72	-6.52
	$1^3D_{2^{+-}(\bar{3}3)_c(\xi_3)}$	6985	755	898	-592	-1.48	-1.2	-5.02
	$1^3D_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7106	763	964	-549	1.67	0.06	-6.35
	$1^3D_{2^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7045	760	927	-565	-4.63	2.05	-6.87
	$1^3D_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7028	774	917	-575	-17.3	2.8	-6.53
	$1^5D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7082	768	948	-556	8.53	1.16	-19.86

TABLE XIX: The average contributions of each part of the Hamiltonian to the $cc\bar{c}\bar{c}$ configurations. $\langle T\rangle$ stands for the contribution of the kinetic energy term. $\langle V^{Lin}\rangle$ and $\langle V^{Coul}\rangle$ stand for the contributions from the linear confinement potential and Coulomb type potential, respectively. $\langle V^{SS}\rangle$, $\langle V^{T}\rangle$, and $\langle V^{LS}\rangle$ stand for the contributions from the spin-spin interaction term, the tensor potential term, and the spin-orbit interaction term, respectively.

$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$	$\langle V^{T}\rangle$	$\langle V^{LS}\rangle$
	$1^5S_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7004	731	911	-581	11.30	0	0
	$1^3P_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6864	735	835	-638	-1.99	-0.4	2.58
	$1^3P_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	6955	739	882	-597	-5.89	0.12	5.19
	$1^3P_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7073	748	941	-543	-14.59	0.59	8.79
	$1^1D_{2^{++}(6\bar{6})_c(\xi_1,\xi_2)}$	6955	733	883	-598	5.68	0	0
	$1^1D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7073	764	947	-563	-6.38	0	0
	$1^1D_{2^{++}(6\bar{6})_c(\xi_3)}$	6964	744	894	-613	6.43	0	0
	$1^1D_{2^{++}(\bar{3}3)_c(\xi_3)}$	6986	754	899	-591	-7.33	0	0
2^{++}	$1^1D_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$	6859	769	829	-647	-24.01	0	0
	$1^1D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7018	787	910	-579	-31.28	0	0
	$1^3D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7073	765	947	-564	-1.19	0.12	-5.47
	$1^3D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7105	764	963	-549	2.77	-1.76	-6.36
	$1^3D_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7045	760	927	-565	-4.2	1.33	-6.87
	$1^5D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7073	766	946	-564	9.24	0.89	-16.46
	$1^5D_{2^{++}(\bar{3}3)_c(\xi_3)}$	6989	752	900	-591	10.19	0.92	-14.97
	$1^5D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7040	761	925	-570	9.03	1.17	-19.07
	$1^5P_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7102	711	964	-529	6.38	1.08	16.13
	$1^3D_{3^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7103	738	967	-545	-0.4	-0.2	12.34
	$1^3D_{3^{+-}(\bar{3}3)_c(\xi_3)}$	7002	733	911	-583	-1.43	0.32	9.54
3^{+-}	$1^3D_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7124	739	979	-539	1.6	-0.02	12.01
	$1^3D_{3^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7062	736	942	-555	-4.4	-0.55	13
	$1^3D_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7043	752	930	-566	-16.57	-0.76	12.43
	$1^5D_{3^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7103	740	965	-545	8.04	2.89	0
	$1^3D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7089	743	960	-555	-1.14	-0.03	10.41
	$1^3D_{3^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7126	736	981	-538	2.59	0.47	11.94
	$1^3D_{3^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	7063	735	942	-555	-3.99	-0.36	12.97
	$1^5D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7091	742	961	-555	8.81	2.24	0
3^{++}	$1^5D_{3^{++}(\bar{3}3)_c(\xi_3)}$	7005	730	913	-582	9.74	2.32	0
	$1^5D_{3^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7060	734	942	-559	8.52	2.92	0
4^{+-}	$1^5D_{4^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	7122	715	982	-536	7.62	-1.36	23.36
	$1^5D_{4^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	7108	720	975	-546	8.42	-1.07	19.74
4^{++}	$1^5D_{4^{++}(\bar{3}3)_c(\xi_3)}$	7020	710	925	-573	9.34	-1.11	18.09
	$1^5D_{4^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	7079	710	957	-549	8.09	-1.38	22.5

TABLE XX: The average contributions of each part of the Hamiltonian to the $cc\bar{c}\bar{c}$ configurations. $\langle T\rangle$ stands for the contribution of the kinetic energy term. $\langle V^{Lin}\rangle$ and $\langle V^{Coul}\rangle$ stand for the contributions from the linear confinement potential and Coulomb type potential, respectively. $\langle V^{SS}\rangle$, $\langle V^{T}\rangle$, and $\langle V^{LS}\rangle$ stand for the contributions from the spin-spin interaction term, the tensor potential term, and the spin-orbit interaction term, respectively.

$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$	$\langle V^{T}\rangle$	$\langle V^{LS}\rangle$
0^{+-}	$2^1S_{0^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$	19840	627	529	-727	3.99		
	$2^1S_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19790	701	543	-864	2.28		
0^{++}	$2^1S_{0^{++}(6\bar{6})_c(\xi_1,\xi_2)}$	19770	653	515	-810	4.48		
	$2^1S_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19797	690	538	-837	-1.21		
	$2^1S_{0^{++}(6\bar{6})_c(\xi_3)}$	19972	646	604	-688	2.36		
	$2^1S_{0^{++}(\bar{3}3)_c(\xi_3)}$	19733	694	510	-881	1.58		
1^{+-}	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19792	700	543	-863	3.81		
	$2^3S_{1^{+-}(\bar{3}3)_c(\xi_3)}$	19735	693	511	-880	3.09		
1^{++}	$^3S_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19800	690	538	-837	1.14		
2^{+-}	$2^5S_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19795	692	546	-859	6.83		
2^{++}	$2^5S_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19804	671	545	-826	5.60		
	$2^5S_{2^{++}(\bar{3}3)_c(\xi_3)}$	19738	692	512	-880	6.11		

TABLE XXI: The average contributions of each part of the Hamiltonian to the $cc\bar{c}\bar{c}$ configurations. $\langle T\rangle$ stands for the contribution of the kinetic energy term. $\langle V^{Lin}\rangle$ and $\langle V^{Coul}\rangle$ stand for the contributions from the linear confinement potential and Coulomb type potential, respectively. $\langle V^{SS}\rangle$, $\langle V^{T}\rangle$, and $\langle V^{LS}\rangle$ stand for the contributions from the spin-spin interaction term, the tensor potential term, and the spin-orbit interaction term, respectively.

$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$	$\langle V^{T}\rangle$	$\langle V^{LS}\rangle$
0^{--}	$1^3P_{0^{--}(6\bar{6})_c(\xi_1,\xi_2)}$	19579	696	438	-968	0.69	5.58	-1.86
	$1^3P_{0^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	19662	685	467	-896	0.41	1.21	-3.63
0^{-+}	$1^3P_{0^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$	19577	701	437	-972	5.25	-0.63	-1.89
	$1^3P_{0^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$	19662	687	467	-898	2.19	-1.22	-3.65
	$1^3P_{0^{-+}(\bar{3}3)_c(\xi_3)}$	19596	713	442	-959	1.86	-2.59	-7.77
1^{--}	$1^3P_{1^{--}(6\bar{6})_c(\xi_1,\xi_2)}$	19571	711	434	-978	0.72	-2.89	-0.96
	$1^3P_{1^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	19662	685	467	-896	0.41	-0.61	-1.82
	$1^5P_{1^{--}(\bar{3}3)_c(\xi_3)}$	19598	711	442	-957	6.58	-1.80	-11.58
	$1^1P_{1^{--}(\bar{3}3)_c(\xi_3)}$	19789	644	517	-785	5.48	0.00	0.00
	$1^1P_{1^{--}(6\bar{6})_c(\xi_3)}$	19604	698	446	-948	-0.49	0.00	0.00
1^{-+}	$1^3P_{1^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$	19579	698	438	-969	5.21	0.31	-0.93
	$1^3P_{1^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$	19665	681	469	-893	2.16	0.60	-1.79
	$1^3P_{1^{-+}(\bar{3}3)_c(\xi_3)}$	19604	699	446	-948	1.81	1.25	-3.75
2^{--}	$1^3P_{2^{--}(6\bar{6})_c(\xi_1,\xi_2)}$	19576	701	437	-971	0.70	0.56	0.94
	$1^3P_{2^{--}(\bar{3}3)_c(\xi_1,\xi_2)}$	19667	677	470	-891	0.41	0.12	1.78
	$1^5P_{2^{--}(\bar{3}3)_c(\xi_3)}$	19609	690	449	-942	6.29	1.71	-3.67
2^{-+}	$1^3P_{2^{-+}(6\bar{6})_c(\xi_1,\xi_2)}$	19580	695	438	-967	5.18	-0.06	0.93
	$1^3P_{2^{-+}(\bar{3}3)_c(\xi_1,\xi_2)}$	19668	675	471	-890	2.15	-0.12	1.77
	$1^3P_{2^{-+}(\bar{3}3)_c(\xi_3)}$	19609	688	449	-941	1.77	-0.24	3.64
3^{--}	$1^5P_{3^{--}(\bar{3}3)_c(\xi_3)}$	19587	723	466	-1026	7.57	-0.61	9.19

TABLE XXII: The average contributions of each part of the Hamiltonian to the $bb\bar{b}\bar{b}$ configurations. $\langle T\rangle$ stands for the contribution of the kinetic energy term. $\langle V^{Lin}\rangle$ and $\langle V^{Coul}\rangle$ stand for the contributions from the linear confinement potential and Coulomb type potential, respectively. $\langle V^{SS}\rangle$, $\langle V^{T}\rangle$, and $\langle V^{LS}\rangle$ stand for the contributions from the spin-spin interaction term, the tensor potential term, and the spin-orbit interaction term, respectively.

$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$	$\langle V^{T}\rangle$	$\langle V^{LS}\rangle$
	$1^3P_{0^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19693	677	482	-876	2.6	0	-0.91
0^{+-}	$1^3P_{0^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19775	667	514	-812	-0.98	0	-1.77
	$1^5D_{0^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19884	674	561	-746	3.24	-1.98	-14.56
	$1^1S_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$	19677	697	475	-893	-9.68	0	0
	$1^1S_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19796	681	523	-801	-13.94	0	0
	$1^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19688	684	480	-881	-0.91	-0.92	-0.92
0^{++}	$1^3P_{0^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19773	670	513	-813	-2.37	-0.36	-1.78
	$1^3P_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19884	655	557	-728	-5.53	0.86	-4.3
	$1^5D_{0^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19873	674	559	-757	3.56	-1.53	-12.13
	$1^5D_{0^{++}(\bar{3}3)_c(\xi_3)}$	19800	678	525	-803	4.05	-1.64	-11.46
	$1^5D_{0^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19847	676	544	-768	3.49	-2.04	-14.25
	$1^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19812	662	535	-796	2.97	0	0
	$1^3S_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19828	653	536	-768	-0.73	0	0
	$1^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19802	671	526	-796	-7.59	0	0
	$1^1P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$	19711	689	488	-864	-9.56	0	0
	$1^1P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19883	656	557	-728	-9.59	0	0
	$1^3P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19692	678	482	-877	2.61	-0.34	-1.02
1^{+-}	$1^3P_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19774	669	514	-813	-0.98	-0.67	-2
	$1^5P_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19890	646	561	-722	2.51	0.21	-5.67
	$1^3D_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19889	664	565	-740	-0.13	-0.26	-7.1
	$1^3D_{1^{+-}(\bar{3}3)_c(\xi_3)}$	19803	672	528	-799	-0.63	0.45	-5.64
	$1^3D_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19906	662	573	-731	0.66	-0.02	-6.86
	$1^3D_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19856	668	548	-758	-1.73	-0.75	-7.58
	$1^3D_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19845	678	543	-769	-6.61	-1.02	-7.15
	$1^5D_{1^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19887	668	563	-742	3.2	-0.97	-11.95
	$1^3S_{1^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19807	667	533	-799	-1.48	0	0
	$1^3S_{1^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19827	655	535	-770	-2.46	0	0
	$1^3P_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19690	681	481	-879	-0.91	0.8	-1.03
	$1^3P_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19773	670	513	-813	-2.37	-0.22	-2.01
	$1^3P_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19883	657	556	-728	-5.55	-1.08	-3.24
1^{++}	$1^3D_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19877	667	562	-753	-0.44	-0.04	-5.96
	$1^3D_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19907	660	574	-730	0.97	0.63	-6.83
	$1^3D_{1^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19856	667	548	-757	-1.6	-0.49	-7.57
	$1^5D_{1^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19876	669	561	-754	3.52	-0.75	-9.98
	$1^5D_{1^{++}(\bar{3}3)_c(\xi_3)}$	19802	673	527	-800	4.01	-0.81	-9.44
	$1^5D_{1^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19850	670	546	-765	3.44	-1	-11.69
	$1^3P_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19695	674	483	-874	2.58	0.07	1.01
	$1^3P_{2^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19779	660	517	-807	-0.96	0.13	1.96
	$1^5P_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19891	645	561	-721	2.5	-1.46	-3.14
	$1^1D_{2^{+-}(6\bar{6})_c(\xi_1,\xi_2)}$	19807	648	525	-777	2.21	0	0
	$1^1D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19895	654	569	-734	-1.73	0	0
2^{+-}	$1^3D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19894	655	568	-735	-0.12	0.26	-2.31
	$1^3D_{2^{+-}(\bar{3}3)_c(\xi_3)}$	19806	667	529	-796	-0.62	-0.44	-1.86
	$1^3D_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19910	654	576	-727	0.65	0.02	-2.24
	$1^3D_{2^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19863	657	552	-751	-1.69	0.73	-2.46
	$1^3D_{2^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19852	666	548	-763	-6.44	0.99	-2.31
	$1^5D_{2^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19893	657	567	-736	3.12	0.41	-6.98

TABLE XXIII: The average contributions of each part of the Hamiltonian to the $bb\bar{b}\bar{b}$ configurations. $\langle T\rangle$ stands for the contribution of the kinetic energy term. $\langle V^{Lin}\rangle$ and $\langle V^{Coul}\rangle$ stand for the contributions from the linear confinement potential and Coulomb type potential, respectively. $\langle V^{SS}\rangle$, $\langle V^{T}\rangle$, and $\langle V^{LS}\rangle$ stand for the contributions from the spin-spin interaction term, the tensor potential term, and the spin-orbit interaction term, respectively.

$J^{P(C)}$	Configuration	Mass	$\langle T\rangle$	$\langle V^{Lin}\rangle$	$\langle V^{Coul}\rangle$	$\langle V^{SS}\rangle$	$\langle V^{T}\rangle$	$\langle V^{LS}\rangle$
	$1^5S_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19814	653	534	-785	4.39	0	0
	$1^3P_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19691	679	481	-878	-0.9	-0.16	1.03
	$1^3P_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19777	662	516	-809	-2.33	0.04	1.97
	$1^3P_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19891	644	562	-721	-5.38	0.21	3.13
	$1^1D_{2^{++}(6\bar{6})_c(\xi_1,\xi_2)}$	19773	661	515	-814	2.27	0	0
	$1^1D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19881	660	564	-749	-2.37	0	0
	$1^1D_{2^{++}(6\bar{6})_c(\xi_3)}$	19770	674	521	-835	2.53	0	0
	$1^1D_{2^{++}(\bar{3}3)_c(\xi_3)}$	19806	666	530	-796	-2.9	0	0
2^{++}	$1^1D_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_2)}$	19697	695	484	-880	-9.67	0	0
	$1^1D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19848	672	546	-766	-11.5	0	0
	$1^3D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19881	660	564	-749	-0.43	0.04	-1.95
	$1^3D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19910	654	576	-727	0.96	-0.62	-2.24
	$1^3D_{2^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19862	657	552	-751	-1.56	0.47	-2.46
	$1^5D_{2^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19881	660	564	-749	3.45	0.32	-5.86
	$1^5D_{2^{++}(\bar{3}3)_c(\xi_3)}$	19807	665	530	-795	3.93	0.34	-5.54
	$1^5D_{2^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19856	659	550	-759	3.36	0.42	-6.83
	$1^5P_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19902	627	569	-711	2.39	0.4	5.98
	$1^3D_{3^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19901	644	573	-729	-0.12	-0.07	4.5
	$1^3D_{3^{+-}(\bar{3}3)_c(\xi_3)}$	19812	657	533	-789	-0.61	0.12	3.62
3^{+-}	$1^3D_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19917	643	581	-720	0.64	-0.01	4.36
	$1^3D_{3^{+-}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19869	647	557	-745	-1.64	-0.2	4.78
	$1^3D_{3^{+-}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19857	657	552	-757	-6.3	-0.28	4.52
	$1^5D_{3^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19901	645	573	-729	3.03	1.05	0
	$1^3D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19887	651	568	-744	-0.42	-0.01	3.81
	$1^3D_{3^{++}(6\bar{6})_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19917	642	581	-720	0.93	0.17	4.35
	$1^3D_{3^{++}(\bar{3}3)_c(\xi_1\otimes\xi_3,\xi_2\otimes\xi_3)}$	19869	646	557	-745	-1.52	-0.13	4.78
	$1^5D_{3^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19887	650	569	-743	3.37	0.82	0
3^{++}	$1^5D_{3^{++}(\bar{3}3)_c(\xi_3)}$	19813	655	534	-788	3.83	0.88	0
	$1^5D_{3^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19864	647	555	-751	3.26	1.08	0
4^{+-}	$1^5D_{4^{+-}(\bar{3}3)_c(\xi_1,\xi_2)}$	19908	634	578	-722	2.94	-0.51	8.74
	$1^5D_{4^{++}(\bar{3}3)_c(\xi_1,\xi_2)}$	19894	640	573	-737	3.29	-0.4	7.41
4^{++}	$1^5D_{4^{++}(\bar{3}3)_c(\xi_3)}$	19819	645	538	-782	3.75	-0.43	7.02
	$1^5D_{4^{++}(6\bar{6})_c(\xi_1\otimes\xi_2)}$	19871	636	560	-744	3.17	-0.52	8.56