Reference = VINOKUROVA 15; JHEP 1506 132
Verifier code = BELLE

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Karim Trabelsi

EMAIL: karim.trabelsi@kek.jp

July 21, 2016

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Sincerely,

Simon Eidelman
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Prospekt Lavrent'eva 11
RU-630090 Novosibirsk
Russian Federation

EMAIL: simon.eidelman@cern.ch

$c\bar{c}$ MESONS

NODE=MXXX025

NODE=M159

$X(3915)$ was $\chi_{c0}(3915)$

$I^G(J^{PC}) = 0^+(0^{++})$

The experimental analysis prefers $J^{PC} = 0^{++}$. However, a re-analysis presented in ZHOU 15C shows that if helicity-2 dominance assumption is abandoned and a sizable helicity-0 component is allowed, a $J^{PC} = 2^{++}$ assignment is possible.

NODE=M159

$X(3915)$ BRANCHING RATIOS

NODE=M159225

$\Gamma(\eta_c\eta)/\Gamma_{total}$ **Γ_4/Γ**

NODE=M159R00
NODE=M159R00

	VALUE	DOCUMENT ID	TECN	COMMENT
YOUR DATA	**not seen**	[8] VINOKUROVA 15	BELL	$B^+ \to K^+\eta_c\eta$

YOUR NOTE [8] VINOKUROVA 15 reports $B(B^+ \to K^+X(3915)^0) \times B(X \to \eta_c\eta) < 3.3 \times 10^{-5}$ at 90% CL.

NODE=M159R00;LINKAGE=VI

$\Gamma(\eta_c\pi^0)/\Gamma_{total}$ **Γ_5/Γ**

NODE=M159R04
NODE=M159R04

	VALUE	DOCUMENT ID	TECN	COMMENT
YOUR DATA	**not seen**	[9] VINOKUROVA 15	BELL	$B^+ \to K^+\eta_c\pi^0$

YOUR NOTE [9] VINOKUROVA 15 reports $B(B^+ \to K^+X(3915)^0) \times B(X \to \eta_c\pi^0) < 1.8 \times 10^{-5}$ at 90% CL.

NODE=M159R04;LINKAGE=VI

$X(3915)$ REFERENCES

NODE=M159

YOUR PAPER	VINOKUROVA 15	JHEP 1506 132	A. Vinokurova *et al.*	(BELLE Collab.)	REFID=56706
	ZHOU 15C	PRL 115 022001	Z.-Y. Zhou, Z. Xiao, H.-Q. Zhou	(BEIJT, NANJ)	REFID=56842

NODE=M213

$X(4020)$

$I(J^P) = 1(?^?)$

Charged X(4020) seen by ABLIKIM 13X from $e^+e^- \to \pi^+\pi^- h_c(1P)$ at c.m. energy from 3.90 to 4.42 GeV as a peak in the invariant mass distribution of the $\pi^\pm h_c(1P)$ system, and by ABLIKIM 14B from $e^+e^- \to (D^*\overline{D}^*)^\pm\pi^\mp$ events in $(D^*\overline{D}^*)^\pm$ mass. A neutral X(4020) seen by ABLIKIM 14P at three c.m. energies in the same range in $e^+e^- \to \pi^0\pi^0 h_c(1P)$ as a peak in the larger of the two masses recoiling against a π^0. ABLIKIM 15AA observes a 5.9 σ signal in $(D^*\overline{D}^*)^0$ in $e^+e^- \to (D^*\overline{D}^*)^0\,\pi^0$ events using collisions at two c.m. energies. Production rates and mass values support grouping neutral and charged X(4020) together as manifestations of a single $I = 1$ particle.

NODE=M213

NODE=M213

$X(4020)$ BRANCHING RATIOS

NODE=M213225

$\Gamma(\eta_c\pi^+\pi^-)/\Gamma_{total}$ **Γ_4/Γ**

NODE=M213R00
NODE=M213R00

	VALUE	DOCUMENT ID	TECN	COMMENT
YOUR DATA	**not seen**	[1] VINOKUROVA 15	BELL	$B^+ \to K^+\eta_c\pi^+\pi^-$

YOUR NOTE [1] VINOKUROVA 15 reports $B(B^+ \to K^+X(4020)^0) \times B(X \to \eta_c\pi^+\pi^-) < 1.6 \times 10^{-5}$ at 90% CL.

NODE=M213R00;LINKAGE=VI

$X(4020)$ REFERENCES

NODE=M213

	ABLIKIM 15AA	PRL 115 182002	M. Ablikim *et al.*	(BES III Collab.)	REFID=56951
YOUR PAPER	VINOKUROVA 15	JHEP 1506 132	A. Vinokurova *et al.*	(BELLE Collab.)	REFID=56706
	ABLIKIM 14B	PRL 112 132001	M. Ablikim *et al.*	(BES III Collab.)	REFID=55654
	ABLIKIM 14P	PRL 113 212002	M. Ablikim *et al.*	(BES III Collab.)	REFID=56118
	ABLIKIM 13X	PRL 111 242001	M. Ablikim *et al.*	(BES III Collab.)	REFID=55635

Reference = SHEN 14; PR D89 072015
Verifier code = BELLE

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$c\bar{c}$ MESONS

NODE=MXXX025

$X(4260)$

NODE=M074

$I^G(J^{PC}) = ?^?(1^{--})$

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54$–10.58 GeV by AUBERT,B 05I, HE 06B, and YUAN 07, and in e^+e^- collisions at $\sqrt{s} \approx 4.26$ GeV by COAN 06. Possibly seen by AUBERT 06 in $B^- \to K^-\pi^+\pi^- J/\psi$. See also the mini-review under the $X(3872)$. (See the index for the page number.)

NODE=M074

$X(4260)$ $\Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M074230

$\Gamma(J/\psi K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_6\Gamma_1/\Gamma$

NODE=M074G3
NODE=M074G3

	VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**<1.7**	90	[1] SHEN	14	BELL	9.4–10.9 $e^+e^- \to \gamma K^+K^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.2	90	[2] YUAN	08	BELL	$e^+e^- \to \gamma K^+K^- J/\psi$

YOUR NOTE

[1] From a fit of the broad $K^+K^- J/\psi$ enhancement including a coherent $X(4260)$ amplitude with mass and width from LIU 13B. Supersedes YUAN 08.

NODE=M074G3;LINKAGE=A

[2] From a fit of the broad $K^+K^- J/\psi$ enhancement including a coherent $X(4260)$ amplitude with mass and width from YUAN 07.

NODE=M074G3;LINKAGE=YU

$\Gamma(J/\psi K^0_S K^0_S) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_1/\Gamma$

NODE=M074G02
NODE=M074G02

	VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**<0.85**	90	[1] SHEN	14	BELL	9.4–10.9 $e^+e^- \to \gamma K^0_S K^0_S J/\psi$

YOUR NOTE

[1] From a fit of the $K^0_S K^0_S J/\psi$ mass range from 4.4 to 5.5 GeV including a coherent $X(4260)$ amplitude with mass and width from LIU 13B.

NODE=M074G02;LINKAGE=A

$X(4260)$ BRANCHING RATIOS

NODE=M074240

$\Gamma(J/\psi K^0_S K^0_S)/\Gamma_{\text{total}}$ Γ_7/Γ

NODE=M074R27
NODE=M074R27

	VALUE	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**not seen**	SHEN	14	BELL	9.4–10.9 $e^+e^- \to \gamma K^0_S K^0_S J/\psi$

$X(4260)$ REFERENCES

NODE=M074

YOUR PAPER	SHEN	14	PR D89 072015	C.P. Shen *et al.*	(BELLE Collab.)	REFID=55944
	LIU	13B	PRL 110 252002	Z.Q. Liu *et al.*	(BELLE Collab.)	REFID=55410
	YUAN	08	PR D77 011105	C.Z. Yuan *et al.*	(BELLE Collab.)	REFID=52135
	YUAN	07	PRL 99 182004	C.Z. Yuan *et al.*	(BELLE Collab.)	REFID=51960
	AUBERT	06	PR D73 011101	B. Aubert *et al.*	(BABAR Collab.)	REFID=51017
	COAN	06	PRL 96 162003	T.E. Coan *et al.*	(CLEO Collab.)	REFID=51075
	HE	06B	PR D74 091104	Q. He *et al.*	(CLEO Collab.)	REFID=51523
	AUBERT,B	05I	PRL 95 142001	B. Aubert *et al.*	(BABAR Collab.)	REFID=50776

Reference = YANG 14; PR D90 112008
Verifier code = BELLE

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$b\bar{b}$ MESONS

NODE=MXXX030

NODE=M049

$\Upsilon(1S)$

$I^G(J^{PC}) = 0^-(1^{--})$

$\Upsilon(1S)$ BRANCHING RATIOS

NODE=M049225

$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{total}$ — **Γ_8/Γ**

NODE=M049R85
NODE=M049R85

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<2.2\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{total}$ — **Γ_9/Γ**

NODE=M049R86
NODE=M049R86

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<3.4\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{total}$ — **Γ_{10}/Γ**

NODE=M049R87
NODE=M049R87

	VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$3.90\pm1.21\pm0.23$	20	YANG	14	BELL	$e^+e^-\to J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c2})/\Gamma_{total}$ — **Γ_{11}/Γ**

NODE=M049R88
NODE=M049R88

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<1.4\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to J/\psi X$

$\Gamma(J/\psi(1S)\eta_c(2S))/\Gamma_{total}$ — **Γ_{12}/Γ**

NODE=M049R89
NODE=M049R89

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<2.2\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to J/\psi X$

$\Gamma(J/\psi(1S)X(3940))/\Gamma_{total}$ — **Γ_{13}/Γ**

NODE=M049R90
NODE=M049R90

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<5.4\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to J/\psi X$

$\Gamma(J/\psi(1S)X(4160))/\Gamma_{total}$ — **Γ_{14}/Γ**

NODE=M049R91
NODE=M049R91

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<5.4\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to J/\psi X$

$\Gamma(\psi(2S)\eta_c)/\Gamma_{total}$ — **Γ_{19}/Γ**

NODE=M049R92
NODE=M049R92

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<3.6\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to \psi(2S)X$

$\Gamma(\psi(2S)\chi_{c0})/\Gamma_{total}$ — **Γ_{20}/Γ**

NODE=M049R93
NODE=M049R93

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<6.5\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to \psi(2S)X$

$\Gamma(\psi(2S)\chi_{c1})/\Gamma_{total}$ — **Γ_{21}/Γ**

NODE=M049R94
NODE=M049R94

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<4.5\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to \psi(2S)X$

$\Gamma(\psi(2S)\chi_{c2})/\Gamma_{total}$ — **Γ_{22}/Γ**

NODE=M049R95
NODE=M049R95

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<2.1\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to \psi(2S)X$

$\Gamma(\psi(2S)\eta_c(2S))/\Gamma_{total}$ — **Γ_{23}/Γ**

NODE=M049R96
NODE=M049R96

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<3.2\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to \psi(2S)X$

$\Gamma(\psi(2S)X(3940))/\Gamma_{total}$ — **Γ_{24}/Γ**

NODE=M049R97
NODE=M049R97

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<2.9\times10^{-6}$	90	YANG	14	BELL	$e^+e^-\to \psi(2S)X$

$\Gamma(\psi(2S)X(4160))/\Gamma_{total}$ Γ_{25}/Γ NODE=M049R98 NODE=M049R98

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<2.9 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Upsilon(1S)$ REFERENCES

NODE=M049

YOUR PAPER YANG 14 PR D90 112008 S.D. Yang *et al.* (BELLE Collab.) REFID=56345

NODE=M052

$\Upsilon(2S)$

$I^G(J^{PC}) = 0^-(1^{--})$

$\Upsilon(2S)$ BRANCHING RATIOS

NODE=M052225

$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{total}$ Γ_9/Γ NODE=M052R53 NODE=M052R53

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<5.4 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{total}$ Γ_{10}/Γ NODE=M052R54 NODE=M052R54

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<3.4 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{total}$ Γ_{11}/Γ NODE=M052R55 NODE=M052R55

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<1.2 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c2})/\Gamma_{total}$ Γ_{12}/Γ NODE=M052R56 NODE=M052R56

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<2.0 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)\eta_c(2S))/\Gamma_{total}$ Γ_{13}/Γ NODE=M052R57 NODE=M052R57

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<2.5 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)X(3940))/\Gamma_{total}$ Γ_{14}/Γ NODE=M052R58 NODE=M052R58

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<2.0 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(J/\psi(1S)X(4160))/\Gamma_{total}$ Γ_{15}/Γ NODE=M052R59 NODE=M052R59

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<2.0 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to J/\psi X$

$\Gamma(\psi(2S)\eta_c)/\Gamma_{total}$ Γ_{16}/Γ NODE=M052R60 NODE=M052R60

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<5.1 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)\chi_{c0})/\Gamma_{total}$ Γ_{17}/Γ NODE=M052R61 NODE=M052R61

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<4.7 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)\chi_{c1})/\Gamma_{total}$ Γ_{18}/Γ NODE=M052R62 NODE=M052R62

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<2.5 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)\chi_{c2})/\Gamma_{total}$ Γ_{19}/Γ NODE=M052R63 NODE=M052R63

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<1.9 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)\eta_c(2S))/\Gamma_{total}$ Γ_{20}/Γ NODE=M052R64 NODE=M052R64

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<3.3 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)X(3940))/\Gamma_{total}$ Γ_{21}/Γ NODE=M052R65 NODE=M052R65

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA $<3.9 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \to \psi(2S)X$

$\Gamma(\psi(2S)X(4160))/\Gamma_{total}$ Γ_{22}/Γ

NODE=M052R66
NODE=M052R66

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	$<3.9 \times 10^{-6}$	90	YANG	14	BELL	$e^+ e^- \to \psi(2S) X$

$\Upsilon(2S)$ REFERENCES

NODE=M052

YOUR PAPER YANG 14 PR D90 112008 S.D. Yang *et al.* (BELLE Collab.) REFID=56345

Reference = CHILIKIN 14; PR D90 112009
Verifier code = BELLE

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$c\bar{c}$ MESONS

NODE=MXXX025

NODE=M231

$X(4200)^{\pm}$ $I(J^P) = ?(1^+)$

OMITTED FROM SUMMARY TABLE

Reported by CHILIKIN 14 in $J/\psi\pi^+$ at a significance of 6.2σ. Assignments of 0^-, 1^-, 2^-, and 2^+ excluded at 6.1σ, 7.4σ, 4.4σ, and 7.0σ level, respectively. Needs confirmation.

NODE=M231

$X(4200)^{\pm}$ MASS

NODE=M231M

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
YOUR DATA **4196^{+31+17}_{-29-13}**	CHILIKIN	14	BELL	$\overline{B}^0 \rightarrow J/\psi K^-\pi^+$

NODE=M231M

$X(4200)^{\pm}$ WIDTH

NODE=M231W

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
YOUR DATA **$370\pm70^{+70}_{-132}$**	CHILIKIN	14	BELL	$\overline{B}^0 \rightarrow J/\psi K^-\pi^+$

NODE=M231W

$X(4200)^{\pm}$ BRANCHING RATIOS

NODE=M231220

$\Gamma(J/\psi\pi^+)/\Gamma_{\text{total}}$ **Γ_1/Γ**

NODE=M231R01

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
YOUR DATA **seen**	CHILIKIN	14	BELL	$\overline{B}^0 \rightarrow J/\psi K^-\pi^+$

NODE=M231R01

$X(4200)^{\pm}$ REFERENCES

NODE=M231

YOUR PAPER	CHILIKIN	14	PR D90 112009	K. Chilikin *et al.*	(BELLE Collab.)

REFID=56344

NODE=M195

$X(4430)^{\pm}$ $I(J^P) = ?(1^+)$

First seen by CHOI 08 in $B \rightarrow K\pi^+\psi(2S)$ decays, confirmed by AAIJ 14AG, and confirmed in a model-independent way by AAIJ 15BH. Also seen by CHILIKIN 14 in $B \rightarrow K^+\pi J/\psi$ decays. J^P was determined by CHILIKIN 13 and AAIJ 14AG.

NODE=M195

$X(4430)^{\pm}$ BRANCHING RATIOS

NODE=M195225

$\Gamma(\pi^+ J/\psi)/\Gamma_{\text{total}}$ **Γ_2/Γ**

NODE=M195R02

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
YOUR DATA **seen**	[1] CHILIKIN	14	BELL	$\overline{B}^0 \rightarrow K^-\pi^+ J/\psi$

NODE=M195R02

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	[2] AUBERT	09AA	BABR	$B \rightarrow K\pi^+ J/\psi$

YOUR NOTE [1] CHILIKIN 14 reports $B(\overline{B}^0 \rightarrow X(4430)^+K^-) \times B(X(4430)^+ \rightarrow J/\psi\pi^+) = (5.4^{+4.0+1.1}_{-1.0-0.9}) \times 10^{-6}$.

NODE=M195R02;LINKAGE=A

[2] AUBERT 09AA quotes $B(B^+ \rightarrow \overline{K}^0 X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ J/\psi) < 1.5 \times 10^{-5}$ and $B(\overline{B}^0 \rightarrow K^- X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ J/\psi) < 0.4 \times 10^{-5}$ at 95% CL.

NODE=M195R02;LINKAGE=AU

$X(4430)^{\pm}$ REFERENCES

NODE=M195

	AAIJ	15BH	PR D92 112009	R. Aaij *et al.*	(LHCb Collab.)
	AAIJ	14AG	PRL 112 222002	R. Aaij *et al.*	(LHCb Collab.) JP
YOUR PAPER	CHILIKIN	14	PR D90 112009	K. Chilikin *et al.*	(BELLE Collab.)
	CHILIKIN	13	PR D88 074026	K. Chilikin *et al.*	(BELLE Collab.) JP
	AUBERT	09AA	PR D79 112001	B. Aubert *et al.*	(BABAR Collab.)
	CHOI	08	PRL 100 142001	S.-K. Choi *et al.*	(BELLE Collab.)

REFID=57110
REFID=55896
REFID=56344
REFID=55551
REFID=52940
REFID=52178

Reference = BALA 15; PR D91 051101
Verifier code = BELLE

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PLEASE REPLY WITHIN ONE WEEK

Karim Trabelsi

EMAIL: karim.trabelsi@kek.jp

July 21, 2016

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Sincerely,

Simon Eidelman
BINP, Budker Inst. of Nuclear Physics
Prospekt Lavrent'eva 11
RU-630090 Novosibirsk
Russian Federation

EMAIL: simon.eidelman@cern.ch

$c\bar{c}$ MESONS

NODE=MXXX025

NODE=M176

$X(3872)$

$I^G(J^{PC}) = 0^+(1^{++})$

First observed by CHOI 03 in $B \to K\pi^+\pi^- J/\psi(1S)$ decays as a narrow peak in the invariant mass distribution of the $\pi^+\pi^- J/\psi(1S)$ final state. Isovector hypothesis excluded by AUBERT 05B and CHOI 11.

NODE=M176

AAIJ 13Q perform a full five-dimensional amplitude analysis of the angular correlations between the decay products in $B^+ \to X(3872)K^+$ decays, where $X(3872) \to J/\psi\pi^+\pi^-$ and $J/\psi \to \mu^+\mu^-$, which unambiguously gives the $J^{PC} = 1^{++}$ assignment under the assumption that the $\pi^+\pi^-$ and J/ψ are in an S-wave. AAIJ 15AO extend this analysis with more data to limit D-wave contributions to $< 4\%$ at 95% CL.

See our note on "Developments in Heavy Quarkonium Spectroscopy".

$X(3872)$ BRANCHING RATIOS

NODE=M176235

$\Gamma(\pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}$ Γ_2/Γ

NODE=M176R6

NODE=M176R6

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
>0.026	93 ± 17	[1] AUBERT	08Y	BABR	$B \to X(3872)K$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
YOUR DATA seen	151	[2] BALA	15	BELL	$B \to X(3872)K\pi$
>0.04	30	[3] AUBERT	05R	BABR	$B^+ \to K^+\pi^+\pi^- J/\psi$
>0.04	36 ± 7	[4] CHOI	03	BABR	$B^+ \to K^+\pi^+\pi^- J/\psi$

[1] AUBERT 08Y reports $[\Gamma(X(3872) \to \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [\text{B}(B^+ \to X(3872)K^+)] = (8.4 \pm 1.5 \pm 0.7) \times 10^{-6}$ which we divide by our best value $\text{B}(B^+ \to X(3872)K^+) < 3.2 \times 10^{-4}$.

NODE=M176R6;LINKAGE=AB

YOUR NOTE [2] BALA 15 reports $\text{B}(X(3872) \to \pi^+\pi^- J/\psi) \times \text{B}(B^0 \to X(3872)K^+\pi^-) = (7.9 \pm 1.3 \pm 0.4) \times 10^{-6}$ and $\text{B}(X(3872) \to \pi^+\pi^- J/\psi) \times \text{B}(B^+ \to X(3872)K^0\pi^+) = (10.6 \pm 3.0 \pm 0.9) \times 10^{-6}$.

NODE=M176R6;LINKAGE=A

[3] Superseded by AUBERT 08Y. AUBERT 05R reports $[\Gamma(X(3872) \to \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [\text{B}(B^+ \to X(3872)K^+)] = (1.28 \pm 0.41) \times 10^{-5}$ which we divide by our best value $\text{B}(B^+ \to X(3872)K^+) < 3.2 \times 10^{-4}$.

NODE=M176R6;LINKAGE=AE

[4] CHOI 03 reports $[\Gamma(X(3872) \to \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [\text{B}(B^+ \to X(3872)K^+)] / [\text{B}(B^+ \to \psi(2S)K^+)] / [\text{B}(\psi(2S) \to J/\psi(1S)\pi^+\pi^-)] = 0.063 \pm 0.012 \pm 0.007$ which we multiply or divide by our best values $\text{B}(B^+ \to X(3872)K^+) < 3.2 \times 10^{-4}$, $\text{B}(B^+ \to \psi(2S)K^+) = (6.26 \pm 0.24) \times 10^{-4}$, $\text{B}(\psi(2S) \to J/\psi(1S)\pi^+\pi^-) = (34.49 \pm 0.30) \times 10^{-2}$.

NODE=M176R6;LINKAGE=CH

$X(3872)$ REFERENCES

NODE=M176

YOUR PAPER	AAIJ	15AO	PR D92 011102	R. Aaij *et al.*	(LHCb Collab.)	REFID=56771
YOUR PAPER	BALA	15	PR D91 051101	A. Bala *et al.*	(BELLE Collab.)	REFID=56408
	AAIJ	13Q	PRL 110 222001	R. Aaij *et al.*	(LHCb Collab.) JP	REFID=54985
	CHOI	11	PR D84 052004	S.-K. Choi *et al.*	(BELLE Collab.)	REFID=53934
	AUBERT	08Y	PR D77 111101	B. Aubert *et al.*	(BABAR Collab.)	REFID=52265
	AUBERT	05B	PR D71 031501	B. Aubert *et al.*	(BABAR Collab.)	REFID=50498
	AUBERT	05R	PR D71 071103	B. Aubert *et al.*	(BABAR Collab.)	REFID=50627
	CHOI	03	PRL 91 262001	S.-K. Choi *et al.*	(BELLE Collab.)	REFID=49628

Reference = HAN 15; PR D92 012011
Verifier code = BELLE

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$c\bar{c}$ MESONS

NODE=MXXX025

NODE=M072

$\psi(4040)$

$I^G(J^{PC}) = 0^-(1^{--})$

$\psi(4040)$ Γ(i) × $\Gamma(e^+e^-)/\Gamma$(total)

NODE=M072235

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{22}\Gamma_1/\Gamma$

NODE=M072G01
NODE=M072G01

	VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**<2.9**	90	[13] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c1}\gamma$
YOUR NOTE	[13] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					

NODE=M072G01;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{23}\Gamma_1/\Gamma$

NODE=M072G02
NODE=M072G02

	VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**<4.6**	90	[14] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c2}\gamma$
YOUR NOTE	[14] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					

NODE=M072G02;LINKAGE=A

$\psi(4040)$ REFERENCES

NODE=M072

YOUR PAPER	HAN	15	PR D92 012011	Y.L. Han *et al.*	(BELLE Collab.)

REFID=56816

NODE=M025

$\psi(4160)$

$I^G(J^{PC}) = 0^-(1^{--})$

$\psi(4160)$ Γ(i) × $\Gamma(e^+e^-)/\Gamma$(total)

NODE=M025235

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{25}\Gamma_1/\Gamma$

NODE=M025G01
NODE=M025G01

	VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**<2.2**	90	[13] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c1}\gamma$
YOUR NOTE	[13] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					

NODE=M025G01;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{26}\Gamma_1/\Gamma$

NODE=M025G02
NODE=M025G02

	VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
	• • • We do not use the following data for averages, fits, limits, etc. • • •					
YOUR DATA	<6.1	90	[14] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c2}\gamma$
YOUR NOTE	[14] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					

NODE=M025G02;LINKAGE=A

$\psi(4160)$ REFERENCES

NODE=M025

YOUR PAPER	HAN	15	PR D92 012011	Y.L. Han *et al.*	(BELLE Collab.)

REFID=56816

NODE=M074

$X(4260)$

$I^G(J^{PC}) = ?^?(1^{--})$

Seen in radiative return from e^+e^- collisions at $\sqrt{s}$ = 9.54–10.58 GeV by AUBERT,B 05I, HE 06B, and YUAN 07, and in e^+e^- collisions at $\sqrt{s} \approx$ 4.26 GeV by COAN 06. Possibly seen by AUBERT 06 in $B^- \to K^-\pi^+\pi^- J/\psi$. See also the mini-review under the $X(3872)$. (See the index for the page number.)

NODE=M074

$X(4260)$ Γ(i) × $\Gamma(e^+e^-)/\Gamma$(total)

NODE=M074230

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{18}\Gamma_1/\Gamma$

NODE=M074G03
NODE=M074G03

	VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**<1.4**	90	[1] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c1}\gamma$
YOUR NOTE	[1] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					

NODE=M074G03;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{total}$ **$\Gamma_{19}\Gamma_1/\Gamma$**

NODE=M074G04
NODE=M074G04

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA **<4.0**	90	[1] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c2}\gamma$
YOUR NOTE [1] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					NODE=M074G04;LINKAGE=A

X(4260) REFERENCES

NODE=M074

YOUR PAPER HAN	15	PR D92 012011	Y.L. Han *et al.*	(BELLE Collab.)	REFID=56816
YUAN	07	PRL 99 182004	C.Z. Yuan *et al.*	(BELLE Collab.)	REFID=51960
AUBERT	06	PR D73 011101	B. Aubert *et al.*	(BABAR Collab.)	REFID=51017
COAN	06	PRL 96 162003	T.E. Coan *et al.*	(CLEO Collab.)	REFID=51075
HE	06B	PR D74 091104	Q. He *et al.*	(CLEO Collab.)	REFID=51523
AUBERT,B	05I	PRL 95 142001	B. Aubert *et al.*	(BABAR Collab.)	REFID=50776

NODE=M181

X(4360)

$I^G(J^{PC}) = ?^?(1^{--})$

Seen in radiative return from e^+e^- collisions at $\sqrt{s}$ = 9.54–10.58 GeV by AUBERT 07S, WANG 07D, and LEES 14F. See also the review under the X(3872) particle listings. (See the index for the page number.)

NODE=M181

X(4360) Γ(i) × Γ(e^+e^-)/Γ(total)

NODE=M181230

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{total}$ **$\Gamma_6\Gamma_1/\Gamma$**

NODE=M181G02
NODE=M181G02

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA **<0.57**	90	[1] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c1}\gamma$
YOUR NOTE [1] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					NODE=M181G02;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{total}$ **$\Gamma_7\Gamma_1/\Gamma$**

NODE=M181G03
NODE=M181G03

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA **<1.9**	90	[1] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c2}\gamma$
YOUR NOTE [1] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					NODE=M181G03;LINKAGE=A

X(4360) REFERENCES

NODE=M181

YOUR PAPER HAN	15	PR D92 012011	Y.L. Han *et al.*	(BELLE Collab.)	REFID=56816
LEES	14F	PR D89 111103	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55938
AUBERT	07S	PRL 98 212001	B. Aubert *et al.*	(BABAR Collab.)	REFID=51724
WANG	07D	PRL 99 142002	X.L. Wang *et al.*	(BELLE Collab.)	REFID=51959

NODE=M073

ψ(4415)

$I^G(J^{PC}) = 0^-(1^{--})$

ψ(4415) Γ(i) × Γ(e^+e^-)/Γ(total)

NODE=M073230

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{total}$ **$\Gamma_{19}\Gamma_{21}/\Gamma$**

NODE=M073G02
NODE=M073G02

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA **<0.47**	90	[15] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c1}\gamma$
YOUR NOTE [15] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					NODE=M073G02;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{total}$ **$\Gamma_{20}\Gamma_{21}/\Gamma$**

NODE=M073G03
NODE=M073G03

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA **<2.3**	90	[16] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c2}\gamma$
YOUR NOTE [16] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					NODE=M073G03;LINKAGE=A

ψ(4415) REFERENCES

NODE=M073

YOUR PAPER HAN	15	PR D92 012011	Y.L. Han *et al.*	(BELLE Collab.)	REFID=56816

NODE=M189

X(4660)

$I^G(J^{PC}) = ?^?(1^{--})$

Seen in radiative return from e^+e^- collisions at $\sqrt{s}$ = 9.54–10.58 GeV by WANG 07D. Also obtained in a combined fit of WANG 07D,

NODE=M189

AUBERT 07S, and LEES 14F. See also the review under the $X(3872)$ particle listings. (See the index for the page number.)

$X(4660)$ $\Gamma(i) \times \Gamma(e^+e^-)/\Gamma(total)$

NODE=M189230

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_5\Gamma_1/\Gamma$

NODE=M189G02
NODE=M189G02

	VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**<0.45**	90	[1] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c1}\gamma$
YOUR NOTE	[1] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					

NODE=M189G02;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_6\Gamma_1/\Gamma$

NODE=M189G03
NODE=M189G03

	VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**<2.1**	90	[1] HAN	15	BELL	10.58 $e^+e^- \to \chi_{c2}\gamma$
YOUR NOTE	[1] Using B($\eta \to \gamma\gamma$) = (39.41 ± 0.21)%.					

NODE=M189G03;LINKAGE=A

$X(4660)$ REFERENCES

NODE=M189

YOUR PAPER	HAN	15	PR D92 012011	Y.L. Han *et al.*	(BELLE Collab.)	REFID=56816
	LEES	14F	PR D89 111103	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55938
	AUBERT	07S	PRL 98 212001	B. Aubert *et al.*	(BABAR Collab.)	REFID=51724
	WANG	07D	PRL 99 142002	X.L. Wang *et al.*	(BELLE Collab.)	REFID=51959

Reference = PAKHLOVA 08B; PRL 101 172001
Verifier code = BELLE

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$c\bar{c}$ MESONS

NODE=MXXX025

NODE=M189

$X(4660)$

$I^G(J^{PC}) = ?^?(1^{--})$

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54$–10.58 GeV by WANG 07D. Also obtained in a combined fit of WANG 07D, AUBERT 07S, and LEES 14F. See also the review under the $X(3872)$ particle listings. (See the index for the page number.)

NODE=M189

$X(4660)$ MASS

NODE=M189M

NODE=M189M

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
4643± 9 OUR AVERAGE		Error includes scale factor of 1.2.			
$4652 \pm 10 \pm 11$	279	[1] WANG	15A	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
$4669 \pm 21 \pm 3$	37	[2] LEES	14F	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
YOUR DATA $4634^{+8}_{-7}{}^{+5}_{-8}$	142	[3] PAKHLOVA	08B	BELL	$e^+e^- \to \Lambda_c^+\Lambda_c^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$4661^{+9}_{-8} \pm 6$	44	[4] LIU	08H	RVUE	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
$4664 \pm 11 \pm 5$	44	WANG	07D	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$

[1] From a two-resonance fit. Supersedes WANG 07D. NODE=M189M;LINKAGE=A

[2] From a two-resonance fit. NODE=M189M;LINKAGE=LE

YOUR NOTE [3] The $\pi^+\pi^-\psi(2S)$ and $\Lambda_c^+\Lambda_c^-$ states are not necessarily the same. NODE=M189M;LINKAGE=PA

[4] From a combined fit of AUBERT 07S and WANG 07D data with two resonances. NODE=M189M;LINKAGE=LI

$X(4660)$ WIDTH

NODE=M189W

NODE=M189W

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
72±11 OUR AVERAGE					
$68 \pm 11 \pm 5$	279	[1] WANG	15A	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
$104 \pm 48 \pm 10$	37	[2] LEES	14F	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
YOUR DATA $92^{+40}_{-24}{}^{+10}_{-21}$	142	[3] PAKHLOVA	08B	BELL	$e^+e^- \to \Lambda_c^+\Lambda_c^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$42^{+17}_{-12} \pm 6$	44	[4] LIU	08H	RVUE	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
$48 \pm 15 \pm 3$	44	WANG	07D	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$

[1] From a two-resonance fit. Supersedes WANG 07D. NODE=M189W;LINKAGE=A

[2] From a two-resonance fit. NODE=M189W;LINKAGE=LE

YOUR NOTE [3] The $\pi^+\pi^-\psi(2S)$ and $\Lambda_c^+\Lambda_c^-$ states are not necessarily the same. NODE=M189W;LINKAGE=B

[4] From a combined fit of AUBERT 07S and WANG 07D data with two resonances. NODE=M189W;LINKAGE=LI

$X(4660)$ BRANCHING RATIOS

NODE=M189225

$\Gamma(\Lambda_c^+\Lambda_c^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_7/\Gamma \times \Gamma_1/\Gamma$**

NODE=M189R03

NODE=M189R03

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA **$0.68^{+0.16}_{-0.15}{}^{+0.29}_{-0.30}$**	142	[1] PAKHLOVA	08B	BELL	$e^+e^- \to \Lambda_c^+\Lambda_c^-$

YOUR NOTE [1] The $\pi^+\pi^-\psi(2S)$ and $\Lambda_c^+\Lambda_c^-$ states are not necessarily the same. NODE=M189R03;LINKAGE=A

$X(4660)$ REFERENCES

NODE=M189

WANG	15A	PR D91 112007	X.L. Wang *et al.*	(BELLE Collab.)	REFID=56839
LEES	14F	PR D89 111103	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55938
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan		REFID=52296
YOUR PAPER PAKHLOVA	08B	PRL 101 172001	C. Pakhlova *et al.*	(BELLE Collab.)	REFID=52596
AUBERT	07S	PRL 98 212001	B. Aubert *et al.*	(BABAR Collab.)	REFID=51724
WANG	07D	PRL 99 142002	X.L. Wang *et al.*	(BELLE Collab.)	REFID=51959

Reference = HE 14; PRL 113 142001
Verifier code = BELLE

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Russian Federation

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$b\bar{b}$ MESONS

NODE=MXXX030

$\Upsilon(10860)$

NODE=M092

$I^G(J^{PC}) = 0^-(1^{--})$

$\Upsilon(10860)$ BRANCHING RATIOS

NODE=M092230

"OUR EVALUATION" is obtained based on averages of rescaled data listed below. The averages and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at http://www.slac.stanford.edu/xorg/hfag/.

NODE=M092230

$\Gamma(\chi_{b0}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ **Γ_{23}/Γ**

NODE=M092R36
NODE=M092R36

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**$<6.3\times10^{-3}$**	90	[31] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b0}(1P)\omega)/\Gamma_{\text{total}}$ **Γ_{24}/Γ**

NODE=M092R37
NODE=M092R37

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**$<3.9\times10^{-3}$**	90	[31] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega})/\Gamma_{\text{total}}$ **Γ_{25}/Γ**

NODE=M092R38
NODE=M092R38

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**$<4.8\times10^{-3}$**	90	[31] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ **Γ_{26}/Γ**

NODE=M092R39
NODE=M092R39

	VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**$1.85\pm0.23\pm0.23$**	80	[31] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b1}(1P)\omega)/\Gamma_{\text{total}}$ **Γ_{27}/Γ**

NODE=M092R40
NODE=M092R40

	VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**$1.57\pm0.22\pm0.21$**	60	[31] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega})/\Gamma_{\text{total}}$ **Γ_{28}/Γ**

NODE=M092R41
NODE=M092R41

	VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**$0.52\pm0.15\pm0.11$**	24	[31] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ **Γ_{29}/Γ**

NODE=M092R42
NODE=M092R42

	VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**$1.17\pm0.27\pm0.14$**	29	[31] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b2}(1P)\omega)/\Gamma_{\text{total}}$ **Γ_{30}/Γ**

NODE=M092R43
NODE=M092R43

	VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**$0.60\pm0.23\pm0.15$**	13	[31] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b2}(1P)\omega)/\Gamma(\chi_{b1}(1P)\omega)$ **Γ_{30}/Γ_{27}**

NODE=M092R44
NODE=M092R44

	VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
YOUR DATA	$0.38\pm0.16\pm0.09$	[32] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega})/\Gamma_{\text{total}}$ **Γ_{31}/Γ**

NODE=M092R45
NODE=M092R45

	VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**$0.61\pm0.22\pm0.28$**	16	[31] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega})/\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega})$ **Γ_{31}/Γ_{28}**

NODE=M092R46
NODE=M092R46

	VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
YOUR DATA	$1.20\pm0.55\pm0.65$	[32] HE	14	BELL	$\Upsilon(5S)\to\pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\gamma X_b \to \gamma \Upsilon(1S)\omega)/\Gamma_{total}$ Γ_{32}/Γ

NODE=M092R47
NODE=M092R47

	VALUE	CL%	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**$<3.8 \times 10^{-5}$**	90	[33] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

YOUR NOTE [31] Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \to b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14. NODE=M092R36;LINKAGE=A

YOUR NOTE [32] Accounting for correlated systematics. NODE=M092R44;LINKAGE=A

YOUR NOTE [33] Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \to b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14. For a state X_b with mass between 10.55 GeV/c^2 and 10.65 GeV/c^2, the obtained 90% upper limit as a function of m_{X_b} varies from 2.6×10^{-5} to 3.8×10^{-5}. NODE=M092R47;LINKAGE=A

$\Upsilon(10860)$ REFERENCES

NODE=M092

YOUR PAPER	HE	14	PRL 113 142001	X.H. He *et al.*	(BELLE Collab.)	REFID=55927
	ESEN	13	PR D87 031101	S. Esen *et al.*	(BELLE Collab.)	REFID=54894