$\Upsilon(11020)$

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

$\Upsilon(11020)$ MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
$10992.9^{+10.0}_{-3.1}$ OUR AVERAGE				
$10999.0^{+7.3+16.9}_{-7.8-1.0}$	[1] MIZUK	16	BELL	$e^+e^- \to h_b(1P,2P)\pi^+\pi^-$
$10987.5^{+6.4+9.1}_{-2.5-2.3}$	[2] SANTEL	16	BELL	$e^+e^- \to \Upsilon(1S,2S,3S)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$11003.0 \pm 1.1^{+0.9}_{-1.0}$	[3,4] SANTEL	16	BELL	$e^+e^- \to$ hadrons
10996 ± 2	[5] AUBERT	09E	BABR	$e^+e^- \to$ hadrons
$11019 \pm 5 \pm 7$	BESSON	85	CLEO	$e^+e^- \to$ hadrons
11020 ± 30	LOVELOCK	85	CUSB	$e^+e^- \to$ hadrons

[1] From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1$, 2 cross sections at 22 energy points within $\sqrt{s}$ = 10.77–11.02 GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

[2] From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1$, 2, 3 cross sections at 25 energy points within $\sqrt{s}$ = 10.6–11.05 GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

[3] From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s}$ = 10.82–11.05 GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

[4] Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

[5] In a model where a flat non-resonant $b\overline{b}$-continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

$\Upsilon(11020)$ WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
49^{+9}_{-15} OUR AVERAGE				
$27^{+27}_{-11}{}^{+5}_{-12}$	[6] MIZUK	16	BELL	$e^+e^- \to h_b(1P,2P)\pi^+\pi^-$
$61^{+9}_{-19}{}^{+2}_{-20}$	[7] SANTEL	16	BELL	$e^+e^- \to \Upsilon(1S,2S,3S)\pi^+\pi^-$

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

$39.3^{+\ 1.7+\ 1.3}_{-\ 1.6-\ 2.4}$		[8,9]	SANTEL	16	BELL	$e^+e^- \to$ hadrons
37 ± 3		[10]	AUBERT	09E	BABR	$e^+e^- \to$ hadrons
61 ±13	±22		BESSON	85	CLEO	$e^+e^- \to$ hadrons
90 ±20			LOVELOCK	85	CUSB	$e^+e^- \to$ hadrons

[6] From a simultaneous fit to the $h_b(\mathrm{nP})\pi^+\pi^-$, $n = 1$, 2 cross sections at 22 energy points within $\sqrt{s} = 10.77$–11.02 GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

[7] From a simultaneous fit to the $\Upsilon(\mathrm{nS})\pi^+\pi^-$, n=1, 2, 3 cross sections at 25 energy points within $\sqrt{s} = 10.6$–11.05 GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

[8] From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82$–11.05 GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

[9] Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

[10] In a model where a flat non-resonant $b\overline{b}$-continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

$\Upsilon(11020)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	e^+e^-	$(2.7^{+1.0}_{-0.8}) \times 10^{-6}$

$\Upsilon(11020)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$ Γ_1

VALUE (keV)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.130±0.030 OUR AVERAGE				
0.095±0.03 ±0.035	BESSON	85	CLEO	$e^+e^- \to$ hadrons
0.156±0.040	LOVELOCK	85	CUSB	$e^+e^- \to$ hadrons

$\Upsilon(11020)$ REFERENCES

MIZUK	16	PRL 117 142001	R. Mizuk *et al.*	(BELLE Collab.)
SANTEL	16	PR D93 011101	D. Santel *et al.*	(BELLE Collab.)
AUBERT	09E	PRL 102 012001	B. Aubert *et al.*	(BABAR Collab.)
BESSON	85	PRL 54 381	D. Besson *et al.*	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock *et al.*	(CUSB Collab.)