

$\Upsilon_2(1D)$ 

$$I^G(J^{PC}) = 0^-(2^{--})$$

was  $\Upsilon(1D)$ 

First observed by BONVICINI 04 in the decay to  $\gamma\gamma \Upsilon(1S)$  and confirmed by DEL-AMO-SANCHEZ 10R in the decay to  $\pi^+\pi^- \Upsilon(1S)$ .

Data consistent with  $J^P = 2^-$ . The states with  $J = 1$  and 3 also possibly seen, but need confirmation.

### $\Upsilon_2(1D)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>10163.7±1.4 OUR AVERAGE</b>		Error includes scale factor of 1.7.		
10164.5±0.8±0.5		DEL-AMO-SA...10R	BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$
10161.1±0.6±1.6	38	BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$

### $\Upsilon_2(1D)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1 \quad \gamma\gamma \Upsilon(1S)$	seen
$\Gamma_2 \quad \gamma\chi_{bJ}(1P)$	seen
$\Gamma_3 \quad \eta \Upsilon(1S)$	not seen
$\Gamma_4 \quad \pi^+\pi^- \Upsilon(1S)$	$(6.6\pm 1.6) \times 10^{-3}$

### $\Upsilon_2(1D)$ BRANCHING RATIOS

$\Gamma(\eta \Upsilon(1S))/\Gamma(\gamma\gamma \Upsilon(1S))$				$\Gamma_3/\Gamma_1$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;0.25</b>	90	BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$

$\Gamma(\pi^+\pi^- \Upsilon(1S))/\Gamma_{\text{total}}$				$\Gamma_4/\Gamma$
VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT	
<b>0.66<sup>+0.15</sup><sub>-0.14</sub> ± 0.06</b>	<sup>1</sup> DEL-AMO-SA...10R	BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$	

<sup>1</sup> Using theoretical predictions for  $B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon_2(1D))$ .

$\Gamma(\pi^+\pi^- \Upsilon(1S))/\Gamma(\gamma\gamma \Upsilon(1S))$				$\Gamma_4/\Gamma_1$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;1.2</b>	90	<sup>2</sup> BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$

<sup>2</sup> Assuming  $J = 2$ .

### $\Upsilon_2(1D)$ REFERENCES

DEL-AMO-SA... 10R	PR D82 111102	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
BONVICINI 04	PR D70 032001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)