NODE=M177

$\Upsilon_2(1D)$

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

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.

NODE=M177

$\Upsilon_2(1D)$ MASS

NODE=M177M

NODE=M177M

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

$\Upsilon_2(1D)$ DECAY MODES

NODE=M177215;NODE=M177

	Mode	Fraction (Γ_i/Γ)	
Γ_1	$\gamma\gamma\,\Upsilon(1S)$	seen	DESIG=1;OUR EVAL;→ UNCHECKED ←
Γ_2	$\gamma\,\chi_{bJ}(1P)$	seen	DESIG=2;OUR EVAL;→ UNCHECKED ←
Γ_3	$\eta\,\Upsilon(1S)$	not seen	DESIG=3;OUR EVAL;→ UNCHECKED ←
Γ_4	$\pi^+\pi^-\,\Upsilon(1S)$	$(6.6\pm1.6)\times10^{-3}$	DESIG=4

$\Upsilon_2(1D)$ BRANCHING RATIOS

NODE=M177225

$\Gamma(\eta\,\Upsilon(1S))/\Gamma(\gamma\gamma\,\Upsilon(1S))$ Γ_3/Γ_1

NODE=M177R01
NODE=M177R01

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.25	90	BONVICINI	04	CLE3	$\Upsilon(3S) \to 4\gamma\ell^+\ell^-$

$\Gamma(\pi^+\pi^-\,\Upsilon(1S))/\Gamma_{\text{total}}$ Γ_4/Γ

NODE=M177R03
NODE=M177R03

VALUE (units 10^{-2})	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{0.66^{+0.15}_{-0.14}\pm0.06}$	[1] DEL-AMO-SA...	10R	BABR	$\Upsilon(3S) \to \gamma\gamma\pi^+\pi^-\ell^+\ell^-$

[1] Using theoretical predictions for B($\chi_{bJ}(2P) \to \gamma\,\Upsilon_2(1D)$).

NODE=M177R03;LINKAGE=DE

$\Gamma(\pi^+\pi^-\,\Upsilon(1S))/\Gamma(\gamma\gamma\,\Upsilon(1S))$ Γ_4/Γ_1

NODE=M177R02
NODE=M177R02

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<1.2	90	[2] BONVICINI	04	CLE3	$\Upsilon(3S) \to 4\gamma\ell^+\ell^-$

[2] Assuming $J = 2$.

NODE=M177R02;LINKAGE=BO

$\Upsilon_2(1D)$ REFERENCES

NODE=M177

DEL-AMO-SA... 10R PR D82 111102 P. del Amo Sanchez *et al.* (BABAR Collab.) REFID=53634
BONVICINI 04 PR D70 032001 G. Bonvicini *et al.* (CLEO Collab.) REFID=49759