b

$I(J^P) = 0(\frac{1}{2}^+)$

Charge $= -\frac{1}{3}\ e$ Bottom $= -1$

b-QUARK MASS

The *b*-quark mass is estimated from bottomonium and *B* masses. It corresponds to the "running" mass m_b ($\mu = m_b$) in the $\overline{\text{MS}}$ scheme. We have converted masses in other schemes to the $\overline{\text{MS}}$ scheme using one-loop QCD pertubation theory with $\alpha_s(\mu{=}m_b) = 0.22$. The range 4.1–4.5 GeV for the $\overline{\text{MS}}$ mass corresponds to 4.5–4.9 GeV for the pole mass (see the "Note on Quark Masses").

VALUE (GeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
4.1 to 4.4 OUR EVALUATION				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.91 ±0.67	[1] ABREU	98I	DLPH	$\overline{\text{MS}}$ scheme
4.15 ±0.05 ±0.20	[2] GIMENEZ	97	LATT	$\overline{\text{MS}}$ scheme
4.13 ±0.06	[3] JAMIN	97	THEO	$\overline{\text{MS}}$ scheme
4.16 ±0.32 ±0.60	[4] RODRIGO	97	THEO	$\overline{\text{MS}}$ scheme
4.22 ±0.05	[5] NARISON	95B	THEO	$\overline{\text{MS}}$ scheme
4.415±0.006	[6] VOLOSHIN	95	THEO	$\overline{\text{MS}}$ scheme
4.0 ±0.1	[7] DAVIES	94	THEO	$\overline{\text{MS}}$ scheme
≥ 4.26	[8] LIGETI	94	THEO	$\overline{\text{MS}}$ scheme
≥ 4.2	[9] LUKE	94	THEO	$\overline{\text{MS}}$ scheme
4.23 ±0.04	[10] NARISON	94	THEO	$\overline{\text{MS}}$ scheme
4.397±0.025	[11] TITARD	94	THEO	$\overline{\text{MS}}$ scheme
4.32 ±0.05	[12] DOMINGUEZ	92	THEO	
4.24 ±0.05	[13] NARISON	89	THEO	
4.18 ±0.02	[14] REINDERS	88	THEO	
4.30 ±0.13	[15] NARISON	87	THEO	
4.25 ±0.1	[16] GASSER	82	THEO	

[1] ABREU 98I determines the $\overline{\text{MS}}$ mass $m_b = 2.67 \pm 0.25 \pm 0.34 \pm 0.27$ GeV at $\mu{=}M_Z$ from three jet heavy quark production at LEP. ABREU 98I have rescaled the result to $\mu = m_b$ using $\alpha_s{=}0.118 \pm 0.003$.

[2] GIMENEZ 97 uses lattice computations of the *B*-meson propagator and the *B*-meson binding energy $\overline{\Lambda}$ in the HQET. Their systematic (second) error for the $\overline{\text{MS}}$ mass is an estimate of the effects of higher-order corrections in the matching of the HQET operators (renormalon effects).

[3] JAMIN 97 apply the QCD moment method to the Υ system. They also find a pole mass of 4.60 ± 0.02.

[4] RODRIGO 97 determines the $\overline{\text{MS}}$ mass $m_b = 2.85 \pm 0.22 \pm 0.20 \pm 0.36$ GeV at $\mu{=}M_Z$ from three jet heavy quark production at LEP. We have rescaled the result.

[5] NARISON 95B uses finite energy sum rules to two-loop accuracy to determine a *b*-quark pole mass of 4.61 ± 0.05 GeV.

[6] VOLOSHIN 95 result was converted from a pole mass of 4827 ± 7 MeV using the one-loop formula. Pole mass was extracted using moments of the total cross section for $e^+e^- \rightarrow$ *b* hadrons.

[7] DAVIES 94 uses lattice computation of Υ spectroscopy. They also quote a value of 5.0 ± 0.2 GeV for the *b*-quark pole mass. The numerical computation includes quark vacuum polarization (unquenched); they find that the masses are independent of n_f to within their errors. Their error for the pole mass is larger than the error for the $\overline{\text{MS}}$ mass,

because both are computed from the bare lattice quark mass, and the conversion for the pole mass is less accurate.

[8] LIGETI 94 computes lower bound of 4.66 GeV on pole mass using HQET, and experimental data on inclusive B and D decays.

[9] LUKE 94 computes lower bound of 4.60 GeV on pole mass using HQET, and experimental data on inclusive B and D decays.

[10] NARISON 94 uses spectral sum rules to two loops, and $J/\psi(1S)$ and Υ systems.

[11] TITARD 94 uses one-loop computation of the quark potential with nonperturbative gluon condensate effects to fit $J/\psi(1S)$ and Υ states.

[12] DOMINGUEZ 92 determines pole mass to be 4.72 ± 0.05 using next-to-leading order in $1/m$ in moment sum rule.

[13] NARISON 89 determines the Georgi-Politzer mass at $p^2=-m^2$ to be 4.23 ± 0.05 GeV using QCD sum rules.

[14] REINDERS 88 determines the Georgi-Politzer mass at $p^2 = -m^2$ to be 4.17 ± 0.02 using moments of $\overline{b}\gamma^\mu b$. This technique leads to a value for the mass of the B meson of 5.25 ± 0.15 GeV.

[15] NARISON 87 determines the pole mass to be 4.70 ± 0.14 using QCD sum rules, with $\Lambda(\overline{\text{MS}}) = 180 \pm 80$ MeV.

[16] GASSER 82 uses SVZ sum rules. The renormalization point is μ = quark mass.

$m_b - m_c$ MASS DIFFERENCE

The mass difference $m_b - m_c$ in the HQET scheme is 3.4 ± 0.2 GeV (see the "Note on Quark Masses").

VALUE (GeV)	*DOCUMENT ID*	
• • • We do not use the following data for averages, fits, limits, etc. • • •		
≥ 3.29	[17] GROSSE	78

[17] GROSSE 78 obtain $(m_b - m_c) \geq 3.29$ GeV based on eigenvalue inequalities in potential models.

b-QUARK REFERENCES

ABREU	98I	PL B418 430	P. Abreu+	(DELPHI Collab.)
GIMENEZ	97	PL B393 124	V. Gimenez, G. Martinelli, C.T. Sachrajda	
JAMIN	97	NP B507 334	M. Jamin, A. Pich	
RODRIGO	97	PRL 79 193	G. Rodrigo, A. Santamaria, M. Bilenky	
NARISON	95B	PL B352 122		(MONP)
VOLOSHIN	95	IJMP A10 2865		(MINN)
DAVIES	94	PRL 73 2654	+Hornbostel+	(GLAS, SMU, CORN, EDIN, OSU, FSU)
LIGETI	94	PR D49 R4331	+Nir	(REHO)
LUKE	94	PL B321 88	+Savage	(TNTO, UCSD, CMU)
NARISON	94	PL B341 73		(CERN, MONP)
TITARD	94	PR D49 6007	+Yndurain	(MICH, MADU)
DOMINGUEZ	92	PL B293 197	+Paver	(CAPE, TRST, INFN)
NARISON	89	PL B216 191		(ICTP)
REINDERS	88	PR D38 947		(BONN)
NARISON	87	PL B197 405		(CERN)
GASSER	82	PRPL 87 77	+Leutwyler	(BERN)
GROSSE	78	PL 79B 103	+Martin	(CERN)