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 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 4.5 OUR EVALUATION				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.22 ±0.05	[1] NARISON	95B	THEO	Assumes $\overline{\text{MS}}$ scheme
4.415±0.006	[2] VOLOSHIN	95	THEO	Assumes $\overline{\text{MS}}$ scheme
4.0 ±0.1	[3] DAVIES	94	THEO	Assumes $\overline{\text{MS}}$ scheme
$\geq$ 4.26	[4] LIGETI	94	THEO	Assumes $\overline{\text{MS}}$ scheme
$\geq$ 4.2	[5] LUKE	94	THEO	Assumes $\overline{\text{MS}}$ scheme
4.23 ±0.04	[6] NARISON	94	THEO	Assumes $\overline{\text{MS}}$ scheme
4.397±0.025	[7] TITARD	94	THEO	Assumes $\overline{\text{MS}}$ scheme
4.32 ±0.05	[8] DOMINGUEZ	92	THEO	
4.24 ±0.05	[9] NARISON	89	THEO	
4.18 ±0.02	[10] REINDERS	88	THEO	
4.30 ±0.13	[11] NARISON	87	THEO	
4.25 ±0.1	[12] GASSER	82	THEO	

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

[2] 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 $e^+e^- \to b$hadrons.

[3] 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.

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

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

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

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

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

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

[10] 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.

[11] 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.

[12] 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. • • •			
$\geq$ 3.29	[13] GROSSE	78	

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

b-QUARK REFERENCES

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)