c

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

Charge $= \frac{2}{3}\,e$ Charm $= +1$

c-QUARK MASS

The c-quark mass corresponds to the "running" mass m_c ($\mu = m_c$) in the $\overline{\mathrm{MS}}$ scheme. We have converted masses in other schemes to the $\overline{\mathrm{MS}}$ scheme using two-loop QCD perturbation theory with $\alpha_s(\mu{=}m_c) = 0.39$. The range 1.0–1.4 GeV for the $\overline{\mathrm{MS}}$ mass corresponds to 1.47–1.83 GeV for the pole mass (see the "Note on Quark Masses").

VALUE (GeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
1.27 $^{+0.07}_{-0.11}$ OUR EVALUATION	See the ideogram below.			
1.286±0.013	[1] KUHN	07	THEO	$\overline{\mathrm{MS}}$ scheme
1.295±0.015	[2] BOUGHEZAL	06	THEO	$\overline{\mathrm{MS}}$ scheme
1.24 ±0.09	[3] BUCHMULLER	06	THEO	$\overline{\mathrm{MS}}$ scheme
1.224±0.017±0.054	[4] HOANG	06	THEO	$\overline{\mathrm{MS}}$ scheme
1.33 ±0.10	[5] AUBERT	04X	THEO	$\overline{\mathrm{MS}}$ scheme
1.29 ±0.07	[6] HOANG	04	THEO	$\overline{\mathrm{MS}}$ scheme
1.319±0.028	[7] DEDIVITIIS	03	LATT	$\overline{\mathrm{MS}}$ scheme
1.19 ±0.11	[8] EIDEMULLER	03	THEO	$\overline{\mathrm{MS}}$ scheme
1.289±0.043	[9] ERLER	03	THEO	$\overline{\mathrm{MS}}$ scheme
1.26 ±0.02	[10] ZYABLYUK	03	THEO	$\overline{\mathrm{MS}}$ scheme
1.26 ±0.04 ±0.12	[11] BECIREVIC	02	LATT	$\overline{\mathrm{MS}}$ scheme
1.301±0.034	[12] ROLF	02	LATT	$\overline{\mathrm{MS}}$ scheme
1.243±0.045	[13] BRAMBILLA	01	THEO	$\overline{\mathrm{MS}}$ scheme
1.04 ±0.04	[14] MARTIN	01	THEO	$\overline{\mathrm{MS}}$ scheme
1.1 ±0.04	[15] NARISON	01B	THEO	$\overline{\mathrm{MS}}$ scheme
1.37 ±0.09	[16] PENARROCHA	01	THEO	$\overline{\mathrm{MS}}$ scheme
1.210±0.070±0.080	[17] PINEDA	01	THEO	$\overline{\mathrm{MS}}$ scheme
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.23 ±0.09	[18] EIDEMULLER	01	THEO	$\overline{\mathrm{MS}}$ scheme
1.304±0.027	[19] KUHN	01	THEO	$\overline{\mathrm{MS}}$ scheme
1.3 ±0.3 ±0.3	[20] ASTIER	00D	NOMD	
1.79 ±0.38	[21] VILAIN	99	THEO	$\overline{\mathrm{MS}}$ scheme

[1] KUHN 07 determine $\overline{m}_c(\mu = 3\text{ GeV}) = 0.986 \pm 0.013$ GeV and $\overline{m}_c(\overline{m}_c)$ from a four-loop sum-rule computation of the cross-section for $e^+e^- \to$ hadrons in the charm threshold region.

[2] BOUGHEZAL 06 result comes from the first moment of the hadronic production cross-section to order α_s^3.

[3] BUCHMULLER 06 determine m_b and m_c by a global fit to inclusive B decay spectra.

[4] HOANG 06 determines $\overline{m}_c(\overline{m}_c)$ from a global fit to inclusive B decay data. The B decay distributions were computed to order $\alpha_s^2\beta_0$, and the conversion between different m_c mass schemes to order α_s^3.

[5] AUBERT 04X obtain m_c from a fit to the hadron mass and lepton energy distributions in semileptonic B decay. The paper quotes values in the kinetic scheme. The $\overline{\mathrm{MS}}$ value has been provided by the BABAR collaboration.

[6] HOANG 04 determines $\overline{m}_c(\overline{m}_c)$ from moments at order α_s^2 of the charm production cross-section in $e^+ e^-$ annihilation.

[7] DEDIVITIIS 03 use a quenched lattice computation of heavy-heavy and heavy-light meson masses.

[8] EIDEMULLER 03 determines m_b and m_c using QCD sum rules.

[9] ERLER 03 determines m_b and m_c using QCD sum rules. Includes recent BES data.

[10] ZYABLYUK 03 determines m_c by using QCD sum rules in the pseudoscalar channel and comparing with the η_c mass.

[11] BECIREVIC 02 uses Monte-Carlo calculations of lattice Ward identities and the D_s mass. The authors estimate an error of about 5% for use of the quenched approximation, not included in systematic error of 0.12.

[12] ROLF 02 determines m_c from a quenched lattice calculation of the D_s mass. The error estimate is for all systematics except the quenched approximation, including lattice spacing effects, finite volume effects, excited states contamination, rounding errors, and the scale uncertainty. The authors estimate the uncertainty due to the quenched approximation may be about 3%.

[13] BRAMBILLA 01 determine $\overline{m}_c(\overline{m}_c)$ from a computation of the J/ψ mass.

[14] MARTIN 01 obtain a pole mass of 1.33–1.4 GeV from an analysis of R, the rate for $e^+ e^- \rightarrow$ hadrons. We have converted this to the $\overline{\text{MS}}$ scheme using the two-loop formula.

[15] NARISON 01B uses pseudoscalar sum rules in the B and D meson channels.

[16] PENARROCHA 01 result is from an analysis of the BES-II $e^+ e^-$ data using finite energy sum rules.

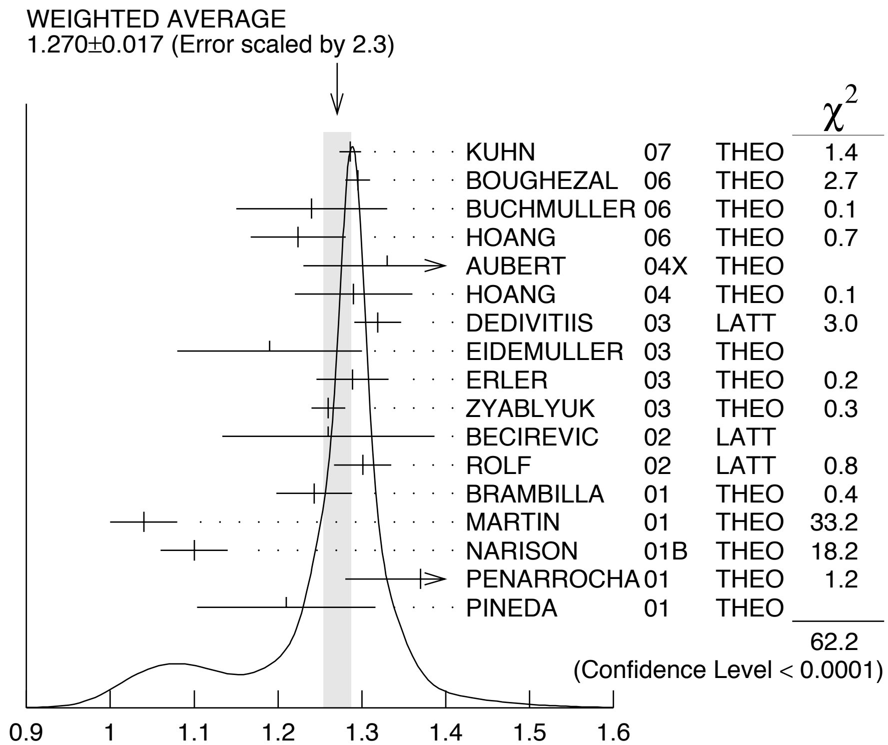
[17] PINEDA 01 uses the $\Upsilon(1S)$ system and the B-D mass difference to determine m_c. The errors are due to theory, and the uncertainty in λ_1 and m_b.

[18] EIDEMULLER 01 result is QCD sum rule analysis of charmonium using NRQCD at next-to-next-to-leading order.

[19] KUHN 01 uses an analysis of the $e^+ e^-$ total cross section to hadrons.

[20] Study of opposite sign dimuon events.

[21] VILAIN 99 obtain the charm quark mass from an analysis of charm production in neutrino scattering.



c-QUARK MASS (GeV)

$m_b - m_c$ QUARK MASS DIFFERENCE

VALUE (GeV)	*DOCUMENT ID*		*TECN*
3.38 to 3.48 OUR EVALUATION			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3.42±0.06	[22] ABDALLAH	06B	DLPH
3.44±0.03	[23] AUBERT	04X	BABR
3.41±0.01	[23] BAUER	04	THEO

[22] ABDALLAH 06B determine $m_b - m_c$ from moments of the hadron invariant mass and lepton energy spectra in semileptonic inclusive B decays.

[23] Determine $m_b - m_c$ from a global fit to inclusive B decay spectra.

c-QUARK REFERENCES

KUHN	07	NP B778 192	J.H. Kuhn, M. Steinhauser, C. Sturm	
ABDALLAH	06B	EPJ C45 35	J. Abdallah *et al.*	(DELPHI Collab.)
BOUGHEZAL	06	PR D74 074006	R. Boughezal, M. Czakon, T. Schutzmeier	
BUCHMULLER	06	PR D73 073008	O.L. Buchmuller, H.U. Flacher	
HOANG	06	PL B633 526	A.H. Hoang, A.V. Manohar	
AUBERT	04X	PRL 93 011803	B. Aubert *et al.*	(BABAR Collab.)
BAUER	04	PR D70 094017	C. Bauer *et al.*	
HOANG	04	PL B594 127	A.H. Hoang, M. Jamin	
DEDIVITIIS	03	NP B675 309	G.M. de Divitiis *et al.*	
EIDEMULLER	03	PR D67 113002	M. Eidemuller	
ERLER	03	PL B558 125	J. Erler, M. Luo	
ZYABLYUK	03	JHEP 0301 081	K.N. Zyablyuk	(ITEP)
BECIREVIC	02	PL B524 115	D. Beciveric, V. Lubicz, G. Martinelli	
ROLF	02	JHEP 0212 007	J. Rolf, S. Sint	
BRAMBILLA	01	PL B513 381	N. Brambilla, Y. Sumino, A. Vairo	

EIDEMULLER	01	PL B498 203	M. Eidemueller, M. Jamin	
KUHN	01	NP B619 588	J.H. Kuhn, M. Steinhauser	
MARTIN	01	EPJ C19 681	A.D. Martin, J. Outhwaite, M.G. Ryskin	
NARISON	01B	PL B520 115	S. Narison	
PENARROCHA	01	PL B515 291	J. Penarrocha, K. Schilcher	
PINEDA	01	JHEP 0106 022	A. Pineda	
ASTIER	00D	PL B486 35	P. Astier *et al.*	(CERN NOMAD Collab.)
VILAIN	99	EPJ C11 19	P. Vilain *et al.*	(CHARM II Collab.)