QUARKS

The u-, d-, and s-quark masses are estimates of so-called "current-quark masses," in a mass-independent subtraction scheme such as $\overline{\text{MS}}$ at a scale $\mu \approx 2$ GeV. The c- and b-quark masses are the "running" masses in the $\overline{\text{MS}}$ scheme. This can be different from the heavy quark masses obtained in potential models.

u

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

$m_u = 2.16^{+0.49}_{-0.26}$ MeV   Charge $= \frac{2}{3}\ e$ $I_z = +\frac{1}{2}$

$m_u/m_d = 0.47^{+0.06}_{-0.07}$

d

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

$m_d = 4.67^{+0.48}_{-0.17}$ MeV   Charge $= -\frac{1}{3}\ e$ $I_z = -\frac{1}{2}$

$m_s/m_d = 17\text{–}22$

$\overline{m} = (m_u+m_d)/2 = 3.45^{+0.55}_{-0.15}$ MeV

s

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

$m_s = 93^{+11}_{-\ 5}$ MeV   Charge $= -\frac{1}{3}\ e$ Strangeness $= -1$

$m_s\ /\ ((m_u + m_d)/2) = 27.3^{+0.7}_{-1.3}$

c

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

$m_c = 1.27 \pm 0.02$ GeV   Charge $= \frac{2}{3}\ e$ Charm $= +1$

$m_c/m_s = 11.72 \pm 0.25$

$m_b/m_c = 4.577 \pm 0.008$

$m_b - m_c = 3.45 \pm 0.05$ GeV

b

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

$m_b = 4.18^{+0.03}_{-0.02}$ GeV   Charge $= -\frac{1}{3}\ e$ Bottom $= -1$

t

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

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

Mass (direct measurements) $m = 172.76 \pm 0.30$ GeV [a,b] (S =
Mass (from cross-section measurements) $m = 162.5^{+2.1}_{-1.5}$ GeV [a
Mass (Pole from cross-section measurements) $m = 172.4 \pm 0.7$
$m_t - m_{\overline{t}} = -0.16 \pm 0.19$ GeV
Full width $\Gamma = 1.42^{+0.19}_{-0.15}$ GeV (S = 1.4)
$\Gamma(W b)/\Gamma(W q(q = b, s, d)) = 0.957 \pm 0.034$ (S = 1.5)

t-quark EW Couplings

$F_0 = 0.687 \pm 0.018$
$F_- = 0.320 \pm 0.013$
$F_+ = 0.002 \pm 0.011$
$F_{V+A} < 0.29$, CL = 95%

t DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$W q(q = b, s, d)$				–
$W b$				–
$e \nu_e b$		(11.10±0.30) %		–
$\mu \nu_\mu b$		(11.40±0.20) %		–
$\tau \nu_\tau b$		(11.1 ±0.9) %		–
$q \overline{q} b$		(66.5 ±1.4) %		–
$\gamma q(q{=}u,c)$		[c] < 1.8 $\times 10^{-4}$	95%	–
$\Delta T = 1$ weak neutral current (*T1*) modes				
$Z q(q{=}u,c)$	T1	[d] < 5 $\times 10^{-4}$	95%	–
$H u$	T1	< 1.2 $\times 10^{-3}$	95%	–
$H c$	T1	< 1.1 $\times 10^{-3}$	95%	–
$\ell^+ \overline{q} \overline{q}'(q{=}d,s,b;\ q'{=}u,c)$	T1	< 1.6 $\times 10^{-3}$	95%	–

b′ (4th Generation) Quark, Searches for

Mass $m >$ 190 GeV, CL = 95% ($p\overline{p}$, quasi-stable b')
Mass $m >$ 1130 GeV, CL = 95% (B($b' \to Z b$) = 1)
Mass $m >$ 1350 GeV, CL = 95% (B($b' \to W t$) = 1)
Mass $m >$ 46.0 GeV, CL = 95% ($e^+ e^-$, all decays)

t′ (4th Generation) Quark, Searches for

$m(t'(2/3)) >$ 1280 GeV, CL = 95% (B($t' \to Z t$) = 1)
$m(t'(2/3)) >$ 1295 GeV, CL = 95% (B($t' \to W b$) = 1)
$m(t'(2/3)) >$ 1310 GeV, CL = 95% (singlet t')
$m(t'(5/3)) >$ 1350 GeV, CL = 95%

Free Quark Searches

All searches since 1977 have had negative results.

NOTES

[*a*] A discussion of the definition of the top quark mass in these measurements can be found in the review "The Top Quark."

[*b*] Based on published top mass measurements using data from Tevatron Run-I and Run-II and LHC at $\sqrt{s} = 7$ TeV. Including the most recent unpublished results from Tevatron Run-II, the Tevatron Electroweak Working Group reports a top mass of 173.2 $\pm$ 0.9 GeV. See the note "The Top Quark' in the Quark Particle Listings of this *Review*.

[*c*] This limit is for $\Gamma(t \rightarrow \gamma q)/\Gamma(t \rightarrow W b)$.

[*d*] This limit is for $\Gamma(t \rightarrow Z q)/\Gamma(t \rightarrow W b)$.