



$$J = \frac{1}{2}$$

e MASS (atomic mass units u)

The primary determination of an electron's mass comes from measuring the ratio of the mass to that of a nucleus, so that the result is obtained in u (atomic mass units). The conversion factor to MeV is more uncertain than the mass of the electron in u; indeed, the recent improvements in the mass determination are not evident when the result is given in MeV. In this datablock we give the result in u, and the following datablock in MeV.

<u>VALUE (10^{-6} u)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
548.5799110 ± 0.0000012	MOHR	99	RVUE 1998 CODATA value
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
548.5799092 ± 0.0000004	¹ BEIER	02	CNTR Penning trap
548.5799111 ± 0.0000012	² FARNHAM	95	CNTR Penning trap
548.579903 ± 0.000013	COHEN	87	RVUE 1986 CODATA value
¹ BEIER 02 compares Larmor frequency of the electron bound in a $^{12}\text{C}^{5+}$ ion with the cyclotron frequency of a single trapped $^{12}\text{C}^{5+}$ ion.			
² FARNHAM 95 compares cyclotron frequency of trapped electrons with that of a single trapped $^{12}\text{C}^{6+}$ ion.			

e MASS

The conversion from u (atomic mass units, see the above datablock) to MeV is 931.494013 ± 0.000037 MeV/u. The conversion error dominates the precision quoted in the following entries.

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.510998902 ± 0.000000021	MOHR	99	RVUE 1998 CODATA value
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.510998901 ± 0.000000020	^{3,4} BEIER	02	CNTR Penning trap
0.510998903 ± 0.000000020	^{3,5} FARNHAM	95	CNTR Penning trap
0.510998895 ± 0.000000024	³ COHEN	87	RVUE 1986 CODATA value
0.5110034 ± 0.0000014	COHEN	73	RVUE 1973 CODATA value
³ Converted to MeV using the 1998 CODATA value of the conversion constant, 931.494013 ± 0.0000037 MeV/u.			
⁴ BEIER 02 compares Larmor frequency of the electron bound in a $^{12}\text{C}^{5+}$ ion with the cyclotron frequency of a single trapped $^{12}\text{C}^{5+}$ ion.			
⁵ FARNHAM 95 compares cyclotron frequency of trapped electrons with that of a single trapped $^{12}\text{C}^{6+}$ ion.			

$$(m_{e^+} - m_{e^-}) / m_{\text{average}}$$

A test of *CPT* invariance.

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$<8 \times 10^{-9}$	90	⁶ FEE	93 CNTR	Positronium spectroscopy
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<4 \times 10^{-8}$	90	CHU	84 CNTR	Positronium spectroscopy
⁶ FEE 93 value is obtained under the assumption that the positronium Rydberg constant is exactly half the hydrogen one.				

$$|q_{e^+} + q_{e^-}|/e$$

A test of *CPT* invariance. See also similar tests involving the proton.

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$<4 \times 10^{-8}$	⁷ HUGHES	92 RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$<2 \times 10^{-18}$	⁸ SCHAEFER	95 THEO	Vacuum polarization
$<1 \times 10^{-18}$	⁹ MUELLER	92 THEO	Vacuum polarization
⁷ HUGHES 92 uses recent measurements of Rydberg-energy and cyclotron-frequency ratios.			
⁸ SCHAEFER 95 removes model dependency of MUELLER 92.			
⁹ MUELLER 92 argues that an inequality of the charge magnitudes would, through higher-order vacuum polarization, contribute to the net charge of atoms.			

e MAGNETIC MOMENT ANOMALY

$$\mu_e/\mu_B - 1 = (g-2)/2$$

For the most accurate theoretical calculation, see KINOSHITA 81.

<u>VALUE (units 10^{-6})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
1159.6521869 ± 0.0000041	¹⁰ MOHR	99 RVUE		1998 CODATA value
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1159.652193 ± 0.000010	¹⁰ COHEN	87 RVUE		1986 CODATA value
1159.6521884 ± 0.0000043	VANDYCK	87 MRS	-	Single electron
1159.6521879 ± 0.0000043	VANDYCK	87 MRS	+	Single positron
¹⁰ The CODATA value assumes the $g/2$ values for e^+ and e^- are equal, as required by <i>CPT</i> .				

$(g_{e^+} - g_{e^-}) / g_{\text{average}}$

A test of *CPT* invariance.

VALUE (units 10^{-12})	CL%	DOCUMENT ID	TECN	COMMENT
$- 0.5 \pm 2.1$		¹¹ VANDYCK	87 MRS	Penning trap
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
< 12	95	¹² VASSERMAN	87 CNTR	Assumes $m_{e^+} = m_{e^-}$
22 ± 64		SCHWINBERG	81 MRS	Penning trap
¹¹ VANDYCK 87 measured $(g_-/g_+) - 1$ and we converted it.				
¹² VASSERMAN 87 measured $(g_+ - g_-)/(g-2)$. We multiplied by $(g-2)/g = 1.2 \times 10^{-3}$.				

e ELECTRIC DIPOLE MOMENT

A nonzero value is forbidden by both *T* invariance and *P* invariance.

VALUE (10^{-26} e cm)	CL%	DOCUMENT ID	TECN	COMMENT
0.069 ± 0.074		REGAN	02 MRS	²⁰⁵ Tl beams
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.18 \pm 0.12 \pm 0.10$		¹³ COMMINS	94 MRS	²⁰⁵ Tl beams
$- 0.27 \pm 0.83$		¹³ ABDULLAH	90 MRS	²⁰⁵ Tl beams
$- 14 \pm 24$		CHO	89 NMR	Tl F molecules
$- 1.5 \pm 5.5 \pm 1.5$		MURTHY	89	Cesium, no <i>B</i> field
$- 50 \pm 110$		LAMOREAUX	87 NMR	¹⁹⁹ Hg
190 ± 340	90	SANDARS	75 MRS	Thallium
70 ± 220	90	PLAYER	70 MRS	Xenon
< 300	90	WEISSKOPF	68 MRS	Cesium
¹³ ABDULLAH 90, COMMINS 94, and REGAN 02 use the relativistic enhancement of a valence electron's electric dipole moment in a high-Z atom.				

e⁻ MEAN LIFE / BRANCHING FRACTION

A test of charge conservation. See the "Note on Testing Charge Conservation and the Pauli Exclusion Principle" following this section in our 1992 edition (Physical Review **D45**, 1 June, Part II (1992), p. VI.10).

Most of these experiments are one of three kinds: Attempts to observe (a) the 255.5 keV gamma ray produced in $e^- \rightarrow \nu_e \gamma$, (b) the (K) shell x ray produced when an electron decays without additional energy deposit, e.g., $e^- \rightarrow \nu_e \bar{\nu}_e \nu_e$ ("disappearance" experiments), and (c) nuclear de-excitation gamma rays after the electron disappears from an atomic shell and the nucleus is left in an excited state. The last can include both weak boson and photon mediating processes. We use the best $e^- \rightarrow \nu_e \gamma$ limit for the Summary Tables.

Note that we use the mean life rather than the half life, which is often reported.

e⁻ → ν_e γ and astrophysical limits

VALUE (yr)	CL%	DOCUMENT ID	TECN	COMMENT
$> 4.6 \times 10^{26}$	90	BACK	02 BORX	$e^- \rightarrow \nu \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$>3.4 \times 10^{26}$	68	BELLI	00B DAMA	$e^- \rightarrow \nu\gamma$, liquid Xe
$>3.7 \times 10^{25}$	68	AHARONOV	95B CNTR	$e^- \rightarrow \nu\gamma$
$>2.35 \times 10^{25}$	68	BALYSH	93 CNTR	$e^- \rightarrow \nu\gamma$, ^{76}Ge detector
$>1.5 \times 10^{25}$	68	AVIGNONE	86 CNTR	$e^- \rightarrow \nu\gamma$
$>1 \times 10^{39}$		¹⁴ ORITO	85 ASTR	Astrophysical argument
$>3 \times 10^{23}$	68	BELLOTTI	83B CNTR	$e^- \rightarrow \nu\gamma$

¹⁴ORITO 85 assumes that electromagnetic forces extend out to large enough distances and that the age of our galaxy is 10^{10} years.

Disappearance and nuclear-de-excitation experiments

<u>VALUE (yr)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$>6.4 \times 10^{24}$	68	¹⁵ BELLI	99B DAMA	De-excitation of ^{129}Xe

• • • We do not use the following data for averages, fits, limits, etc. • • •

$>4.2 \times 10^{24}$	68	BELLI	99 DAMA	Iodine L-shell disappearance
$>2.4 \times 10^{23}$	90	¹⁶ BELLI	99D DAMA	De-excitation of ^{127}I (in NaI)
$>4.3 \times 10^{23}$	68	AHARONOV	95B CNTR	Ge K-shell disappearance
$>2.7 \times 10^{23}$	68	REUSSER	91 CNTR	Ge K-shell disappearance
$>2 \times 10^{22}$	68	BELLOTTI	83B CNTR	Ge K-shell disappearance

¹⁵BELLI 99B limit on charge nonconserving e^- capture involving excitation of the 236.1 keV nuclear state of ^{129}Xe ; the 90% CL limit is 3.7×10^{24} yr. Less stringent limits for other states are also given.

¹⁶BELLI 99D limit on charge nonconserving e^- capture involving excitation of the 57.6 keV nuclear state of ^{127}I . Less stringent limits for the other states and for the state of ^{23}Na are also given.

e REFERENCES

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MOHR	99	JPCRD 28 1713	P.J. Mohr, B.N. Taylor	(NIST)
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AHARONOV	95B	PR D52 3785	Y. Aharonov <i>et al.</i>	(SCUC, PNL, ZAGR+)
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ORITO	85	PRL 54 2457	S. Orito, M. Yoshimura	(TOKY, KEK)
CHU	84	PRL 52 1689	S. Chu, A.P. Mills, J.L. Hall	(BELL, NBS, COLO)
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PLAYER	70	JPB 3 1620	M.A. Player, P.G.H. Sandars	(OXF)
WEISSKOPF	68	PRL 21 1645	M.C. Weisskopf <i>et al.</i>	(BRAN)
