$\sin^2(2\theta)$ for "Large" $\Delta(m^2)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<4.4 × 10^{-2}	90	ASRATYAN 81	HLBC	FNAL
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.15	90	BOFILL 87	CNTR	FNAL
<8.8 × 10^{-2}	90	TAYLOR 83	HLBC	15-ft FNAL

– – – – $\nu_\mu(\overline{\nu}_\mu) \rightarrow \nu_\tau(\overline{\nu}_\tau)$ – – – –

$\Delta(m^2)$ for $\sin^2(2\theta) = 1$

VALUE (eV^2)	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	[110] GRUWE 93	CHM2	CERN SPS

[110] GRUWE 93 is a search using the CHARM II detector in the CERN SPS wide-band neutrino beam for $\nu_\mu \rightarrow \nu_\tau$ and $\overline{\nu}_\mu \rightarrow \overline{\nu}_\tau$ oscillations signalled by quasi-elastic ν_τ and $\overline{\nu}_\tau$ interactions followed by the decay $\tau \rightarrow \nu_\tau \pi$. The maximum sensitivity in $\sin^2 2\theta$ ($< 6.4 \times 10^{-3}$ at the 90% CL) is reached for $\Delta(m^2) \simeq 50$ eV^2.

$\sin^2(2\theta)$ for "Large" $\Delta(m^2)$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	[111] GRUWE 93	CHM2	CERN SPS

[111] GRUWE 93 is a search using the CHARM II detector in the CERN SPS wide-band neutrino beam for $\nu_\mu \rightarrow \nu_\tau$ and $\overline{\nu}_\mu \rightarrow \overline{\nu}_\tau$ oscillations signalled by quasi-elastic ν_τ and $\overline{\nu}_\tau$ interactions followed by the decay $\tau \rightarrow \nu_\tau \pi$. The maximum sensitivity in $\sin^2 2\theta$ ($< 6.4 \times 10^{-3}$ at the 90% CL) is reached for $\Delta(m^2) \simeq 50$ eV^2.

– – – – $\nu_e \rightarrow (\overline{\nu}_e)_L$ – – – –

This is a limit on lepton family-number violation and total lepton-number violation. $(\overline{\nu}_e)_L$ denotes a hypothetical left-handed $\overline{\nu}_e$. The bound is quoted in terms of $\Delta(m^2)$, $\sin(2\theta)$, and α, where α denotes the fractional admixture of $(V+A)$ charged current.

$\alpha\Delta(m^2)$ for $\sin^2(2\theta) = 1$

VALUE (eV^2)	CL%	DOCUMENT ID	TECN	COMMENT
<0.14	90	[112] FREEDMAN 93	CNTR	LAMPF
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<7	90	[113] COOPER 82	HLBC	BEBC CERN SPS

[112] FREEDMAN 93 is a search at LAMPF for $\overline{\nu}_e$ generated from any of the three neutrino types ν_μ, $\overline{\nu}_\mu$, and ν_e which come from the beam stop. The $\overline{\nu}_e$'s would be detected by the reaction $\overline{\nu}_e p \rightarrow e^+ n$.

[113] COOPER 82 states that existing bounds on V+A currents require α to be small.

$\alpha^2\sin^2(2\theta)$ for "Large" $\Delta(m^2)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.032	90	[114] FREEDMAN 93	CNTR	LAMPF
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.05	90	[115] COOPER 82	HLBC	BEBC CERN SPS

[114] FREEDMAN 93 is a search at LAMPF for $\overline{\nu}_e$ generated from any of the three neutrino types ν_μ, $\overline{\nu}_\mu$, and ν_e which come from the beam stop. The $\overline{\nu}_e$'s would be detected by the reaction $\overline{\nu}_e p \rightarrow e^+ n$.

[115] COOPER 82 states that existing bounds on V+A currents require α to be small.

– – – – $\nu_\mu \rightarrow (\overline{\nu}_e)_L$ – – – –

See note above for $\nu_e \rightarrow (\overline{\nu}_e)_L$ limit

$\alpha\Delta(m^2)$ for $\sin^2(2\theta) = 1$

VALUE (eV^2)	CL%	DOCUMENT ID	TECN	COMMENT
<0.16	90	[116] FREEDMAN 93	CNTR	LAMPF
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.7	90	[117] COOPER 82	HLBC	BEBC CERN SPS

[116] FREEDMAN 93 is a search at LAMPF for $\overline{\nu}_e$ generated from any of the three neutrino types ν_μ, $\overline{\nu}_\mu$, and ν_e which come from the beam stop. The $\overline{\nu}_e$'s would be detected by the reaction $\overline{\nu}_e p \rightarrow e^+ n$. The limit on $\Delta(m^2)$ is better than the CERN BEBC experiment, but the limit on $\sin^2\theta$ is almost a factor of 100 less sensitive.

[117] COOPER 82 states that existing bounds on V+A currents require α to be small.

$\alpha^2\sin^2(2\theta)$ for "Large" $\Delta(m^2)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.001	90	[118] COOPER 82	HLBC	BEBC CERN SPS
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.07	90	[119] FREEDMAN 93	CNTR	LAMPF

[118] COOPER 82 states that existing bounds on V+A currents require α to be small.

[119] FREEDMAN 93 is a search at LAMPF for $\overline{\nu}_e$ generated from any of the three neutrino types ν_μ, $\overline{\nu}_\mu$, and ν_e which come from the beam stop. The $\overline{\nu}_e$'s would be detected by the reaction $\overline{\nu}_e p \rightarrow e^+ n$. The limit on $\Delta(m^2)$ is better than the CERN BEBC experiment, but the limit on $\sin^2\theta$

– – – – (ii) Disappearance experiments – – – –

– – – – $\nu_e \not\rightarrow \nu_e$ – – – –

$\Delta(m^2)$ for $\sin^2(2\theta) = 1$

VALUE (eV^2)	CL%	DOCUMENT ID	TECN	COMMENT
<2.3 OUR LIMIT				
< 8	90	BAKER 81	HLBC	15-ft FNAL
<2.3 OR >8	90	NEMETHY 81B	CNTR	LAMPF
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<14.9	90	BRUCKER 86	HLBC	15-ft FNAL
<56	90	DEDEN 81	HLBC	BEBC CERN SPS
<10	90	ERRIQUEZ 81	HLBC	BEBC CERN SPS

$\sin^2(2\theta)$ for "Large" $\Delta(m^2)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7 × 10^{-2}	90	ERRIQUEZ 81	HLBC	BEBC CERN SPS
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.54	90	BRUCKER 86	HLBC	15-ft FNAL
<0.6	90	BAKER 81	HLBC	15-ft FNAL
<0.3	90	DEDEN 81	HLBC	BEBC CERN SPS

– – – – $\nu_\mu \not\rightarrow \nu_\mu$ – – – –

$\Delta(m^2)$ for $\sin^2(2\theta) = 1$

These experiments also allow sufficiently large $\Delta(m^2)$.

VALUE (eV^2)	CL%	DOCUMENT ID	TECN	COMMENT
<0.23 OR >1500 OUR LIMIT				
<0.23 OR >100	90	DYDAK 84	CNTR	
<13 OR >1500	90	STOCKDALE 84	CNTR	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.29 OR >22	90	BERGSMA 88	CHRM	
<7	90	BELIKOV 85	CNTR	Serpukhov
<8.0 OR >1250	90	STOCKDALE 85	CNTR	
<0.29 OR >22	90	BERGSMA 84	CHRM	
<8.0	90	BELIKOV 83	CNTR	

$\sin^2(2\theta)$ for $\Delta(m^2) = 100$eV^2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.02	90	[120] STOCKDALE 85	CNTR	FNAL
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.17	90	[121] BERGSMA 88	CHRM	
<0.07	90	[122] BELIKOV 85	CNTR	Serpukhov
<0.27	90	[121] BERGSMA 84	CHRM	CERN PS
<0.1	90	[123] DYDAK 84	CNTR	CERN PS
<0.02	90	[124] STOCKDALE 84	CNTR	FNAL
<0.1	90	[125] BELIKOV 83	CNTR	Serpukhov

[120] This bound applies for $\Delta(m^2) = 100$ eV^2. Less stringent bounds apply for other $\Delta(m^2)$; these are nontrivial for $8 < \Delta(m^2) < 1250$ eV^2.

[121] This bound applies for $\Delta(m^2) = 0.7$–$9.$ eV^2. Less stringent bounds apply for other $\Delta(m^2)$; these are nontrivial for $0.28 < \Delta(m^2) < 22$ eV^2.

[122] This bound applies for a wide range of $\Delta(m^2) > 7$ eV^2. For some values of $\Delta(m^2)$, the value is less stringent; the least restrictive, nontrivial bound occurs approximately at $\Delta(m^2) = 300$ eV^2 where $\sin^2(2\theta) < 0.13$ at CL = 90%.

[123] This bound applies for $\Delta(m^2) = 1.$–$10.$ eV^2. Less stringent bounds apply for other $\Delta(m^2)$; these are nontrivial for $0.23 < \Delta(m^2) < 90$ eV^2.

[124] This bound applies for $\Delta(m^2) = 110$ eV^2. Less stringent bounds apply for other $\Delta(m^2)$; these are nontrivial for $13 < \Delta(m^2) < 1500$ eV^2.

[125] Bound holds for $\Delta(m^2) = 20$–1000 eV^2.

– – – – $\overline{\nu}_\mu \not\rightarrow \overline{\nu}_\mu$ – – – –

$\Delta(m^2)$ for $\sin^2(2\theta) = 1$

VALUE (eV^2)	CL%	DOCUMENT ID	TECN
<7 OR >1200 OUR LIMIT			
<7 OR >1200	90	STOCKDALE 85	CNTR

$\sin^2(2\theta)$ for 190 eV^2 $< \Delta(m^2) <$ 320 eV^2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.02	90	[126] STOCKDALE 85	CNTR	FNAL

[126] This bound applies for $\Delta(m^2)$ between 190 and 320 or $= 530$ eV^2. Less stringent bounds apply for other $\Delta(m^2)$; these are nontrivial for $7 < \Delta(m^2) < 1200$ eV^2.