1. Lepton Flavor Violation

Table 1: HFAG Winter 2012 upper limit for the lepton flavor violating τ decay modes. L means lepton number violation as well as the lepton flavor violation.

Decay mode	Category	Upper limit at 90%			Exp.	Ref.
$\Gamma_{156} = e^-\gamma$	$l\gamma$	$< 12.$	$\cdot$	10^{-8}	Belle	[1]
		< 3.3	$\cdot$	10^{-8}	Babar	[2]
$\Gamma_{157} = \mu^-\gamma$		< 4.5	$\cdot$	10^{-8}	Belle	[1]
		< 4.4	$\cdot$	10^{-8}	Babar	[2]
$\Gamma_{158} = e^-\pi^0$	lP^0	< 2.2	$\cdot$	10^{-8}	Belle	[3]
		$< 13.$	$\cdot$	10^{-8}	Babar	[4]
$\Gamma_{159} = \mu^-\pi^0$		< 2.7	$\cdot$	10^{-8}	Belle	[3]
		$< 11.$	$\cdot$	10^{-8}	Babar	[4]
$\Gamma_{162} = e^-\eta$		< 4.4	$\cdot$	10^{-8}	Belle	[3]
		$< 16.$	$\cdot$	10^{-8}	Babar	[4]
$\Gamma_{163} = \mu^-\eta$		< 2.3	$\cdot$	10^{-8}	Belle	[3]
		$< 15.$	$\cdot$	10^{-8}	Babar	[4]
$\Gamma_{172} = e^-\eta'(958)$		< 3.6	$\cdot$	10^{-8}	Belle	[3]
		$< 24.$	$\cdot$	10^{-8}	Babar	[4]
$\Gamma_{173} = \mu^-\eta'(958)$		< 3.8	$\cdot$	10^{-8}	Belle	[3]
		$< 14.$	$\cdot$	10^{-8}	Babar	[4]
$\Gamma_{160} = e^-K_S^0$		< 2.6	$\cdot$	10^{-8}	Belle	[5]
		< 3.3	$\cdot$	10^{-8}	Babar	[6]
$\Gamma_{161} = \mu^-K_S^0$		< 2.3	$\cdot$	10^{-8}	Belle	[5]
		< 4.0	$\cdot$	10^{-8}	Babar	[6]
$\Gamma_{174} = e^-f_0(958)$	lS^0	< 3.2	$\cdot$	10^{-8}	Belle	[7]
$\Gamma_{175} = \mu^-f_0(958)$		< 3.4	$\cdot$	10^{-8}	Belle	[7]
$\Gamma_{164} = e^-\rho^0$	lV^0	< 1.8	$\cdot$	10^{-8}	Belle	[8]
		< 4.6	$\cdot$	10^{-8}	Babar	[9]
$\Gamma_{165} = \mu^-\rho^0$		< 1.2	$\cdot$	10^{-8}	Belle	[8]
		< 2.6	$\cdot$	10^{-8}	Babar	[9]
$\Gamma_{168} = e^-K^*(892)^0$		< 3.2	$\cdot$	10^{-8}	Belle	[8]
		< 5.9	$\cdot$	10^{-8}	Babar	[9]
$\Gamma_{169} = \mu^-K^*(892)^0$		< 7.2	$\cdot$	10^{-8}	Belle	[8]
		$< 17.$	$\cdot$	10^{-8}	Babar	[9]
$\Gamma_{170} = e^-\bar{K}^*(892)^0$		< 3.4	$\cdot$	10^{-8}	Belle	[8]
		< 4.6	$\cdot$	10^{-8}	Babar	[9]
$\Gamma_{171} = \mu^-\bar{K}^*(892)^0$		< 7.0	$\cdot$	10^{-8}	Belle	[8]
		< 7.3	$\cdot$	10^{-8}	Babar	[9]
$\Gamma_{176} = e^-\phi$		< 3.1	$\cdot$	10^{-8}	Belle	[8]
		< 3.1	$\cdot$	10^{-8}	Babar	[9]

$\Gamma_{177} = \mu^-\phi$		< 8.4	$\cdot$	10^{-8}	Belle	[8]
		$< 19.$	$\cdot$	10^{-8}	Babar	[9]
$\Gamma_{166} = e^-\omega$		< 4.8	$\cdot$	10^{-8}	Belle	[8]
		$< 11.$	$\cdot$	10^{-8}	Babar	[10]
$\Gamma_{167} = \mu^-\omega$		< 4.7	$\cdot$	10^{-8}	Belle	[8]
		$< 10.$	$\cdot$	10^{-8}	Babar	[10]
$\Gamma_{178} = e^-e^+e^-$	lll	< 2.7	$\cdot$	10^{-8}	Belle	[11]
		< 2.9	$\cdot$	10^{-8}	Babar	[12]
$\Gamma_{181} = \mu^-e^+e^-$		< 1.8	$\cdot$	10^{-8}	Belle	[11]
		< 2.2	$\cdot$	10^{-8}	Babar	[12]
$\Gamma_{179} = e^-\mu+\mu-$		< 2.7	$\cdot$	10^{-8}	Belle	[11]
		< 3.2	$\cdot$	10^{-8}	Babar	[12]
$\Gamma_{183} = \mu^-\mu+\mu-$		< 2.1	$\cdot$	10^{-8}	Belle	[11]
		< 3.3	$\cdot$	10^{-8}	Babar	[12]
$\Gamma_{182} = e^-\mu+e^-$		< 1.5	$\cdot$	10^{-8}	Belle	[11]
		< 1.8	$\cdot$	10^{-8}	Babar	[12]
$\Gamma_{180} = \mu^-e^+\mu-$		< 1.7	$\cdot$	10^{-8}	Belle	[11]
		< 2.6	$\cdot$	10^{-8}	Babar	[12]
$\Gamma_{184} = e^-\pi^+\pi^-$	lhh	< 2.3	$\cdot$	10^{-8}	Belle	[13]
		$< 12.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{186} = \mu^-\pi^+\pi^-$		< 2.1	$\cdot$	10^{-8}	Belle	[13]
		$< 29.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{188} = e^-\pi^+K^-$		< 3.7	$\cdot$	10^{-8}	Belle	[13]
		$< 32.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{194} = \mu^-\pi^+K^-$		< 8.6	$\cdot$	10^{-8}	Belle	[13]
		$< 26.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{189} = e^-K^+\pi^-$		< 3.1	$\cdot$	10^{-8}	Belle	[13]
		$< 17.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{195} = \mu^-K^+\pi^-$		< 4.5	$\cdot$	10^{-8}	Belle	[13]
		$< 32.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{192} = e^-K^+K^-$		< 3.4	$\cdot$	10^{-8}	Belle	[13]
		$< 14.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{198} = \mu^-K^+K^-$		< 4.4	$\cdot$	10^{-8}	Belle	[13]
		$< 25.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{191} = e^-K_S^0K_S^0$		< 7.1	$\cdot$	10^{-8}	Belle	[5]
$\Gamma_{197} = \mu^-K_S^0K_S^0$		< 8.0	$\cdot$	10^{-8}	Belle	[5]
$\Gamma_{185} = e^+\pi^-\pi^-$	(L)	< 2.0	$\cdot$	10^{-8}	Belle	[13]
	(L)	$< 27.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{187} = \mu^+\pi^-\pi^-$	(L)	< 3.9	$\cdot$	10^{-8}	Belle	[13]
	(L)	< 7.0	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{190} = e^+\pi^-K^-$	(L)	< 3.2	$\cdot$	10^{-8}	Belle	[13]
	(L)	$< 18.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{196} = \mu^+\pi^-K^-$	(L)	< 4.8	$\cdot$	10^{-8}	Belle	[13]

	(L)	$< 22.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{193} = e^+ K^- K^-$	(L)	< 3.3	$\cdot$	10^{-8}	Belle	[13]
	(L)	$< 15.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{199} = \mu^+ K^- K^-$	(L)	< 4.7	$\cdot$	10^{-8}	Belle	[13]
	(L)	$< 48.$	$\cdot$	10^{-8}	Babar	[14]
$\Gamma_{211} = \pi^- \Lambda$	$\Lambda\, h$	< 3.0	$\cdot$	10^{-8}	Belle	[15]
		< 5.8	$\cdot$	10^{-8}	Babar	[16]
$\Gamma_{212} = \pi^- \bar{\Lambda}$		< 2.8	$\cdot$	10^{-8}	Belle	[15]
		< 5.9	$\cdot$	10^{-8}	Babar	[16]
$\Gamma_{xx} = K^- \Lambda$		< 4.2	$\cdot$	10^{-8}	Belle	[15]
		$< 15.$	$\cdot$	10^{-8}	Babar	[16]
$\Gamma_{xx} = K^- \bar{\Lambda}$		< 3.1	$\cdot$	10^{-8}	Belle	[15]
		< 7.2	$\cdot$	10^{-8}	Babar	[16]

References

[1] K. Hayasaka, et al., Phys.Lett. B666 (2008) 16–22.

[2] B. Aubert, et al., Phys.Rev.Lett. 104 (2010) 021802.

[3] K. Hayasaka, J.Phys.:Conf.Ser. 335 (2011) 012029. See http://iopscience.iop.org/1742-6596/335/1/012029/.

[4] B. Aubert, et al., Phys.Rev.Lett. 98 (2007) 061803.

[5] Y. Miyazaki, Phys.Lett. B692 (2010) 4–9.

[6] B. Aubert, et al., Phys.Rev. D79 (2009) 012004.

[7] Y. Miyazaki, et al., Phys. Lett. B672 (2009) 317–322.

[8] Y. Miyazaki, Phys.Lett. B699 (2011) 251–257.

[9] B. Aubert, et al., Phys.Rev.Lett. 103 (2009) 021801.

[10] B. Aubert, et al., Phys.Rev.Lett. 100 (2008) 071802.

[11] K. Hayasaka, K. Inami, Y. Miyazaki, et al., Phys. Lett. B687 (2010) 139–143.

[12] J. Lees, et al., Phys.Rev. D81 (2010) 111101.

[13] Y. Miyazaki, Search for Lepton-Flavor-Violating and Lepton-Number-Violating $\tau^- \to lhh'$ Decays Mode , 2011. A talk presented at International Workshop on e^+e^- collisions from phi to psi (PHIPSI11), Novosibirsk, 19-22 Sep 2011, http://phipsi11.inp.nsk.su/talks/phipsi11_hayasaka.pdf.

[14] B. Aubert, et al., Phys.Rev.Lett. 95 (2005) 191801.

[15] K. Hayasaka, Recent LFV results on tau lepton from Belle , 2011. A talk presented at International Workshop on e^+e^- collisions from phi to psi (PHIPSI11), Novosibirsk, 19-22 Sep 2011. http://phipsi11.inp.nsk.su/talks/phipsi11_hayasaka.pdf.

[16] G. Lafferty, Nucl.Phys.Proc.Suppl. 169 (2007) 186–191.