Non-Standard Effects in Neutrino Oscillations

Mainly based on JHEP 06(2005)049 and hep-ph/0508175
In collaboration with Tommy Ohlsson and Walter Winter

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Outline

- Motivation and general introduction

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- Some examples

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- Coherent and incoherent effects

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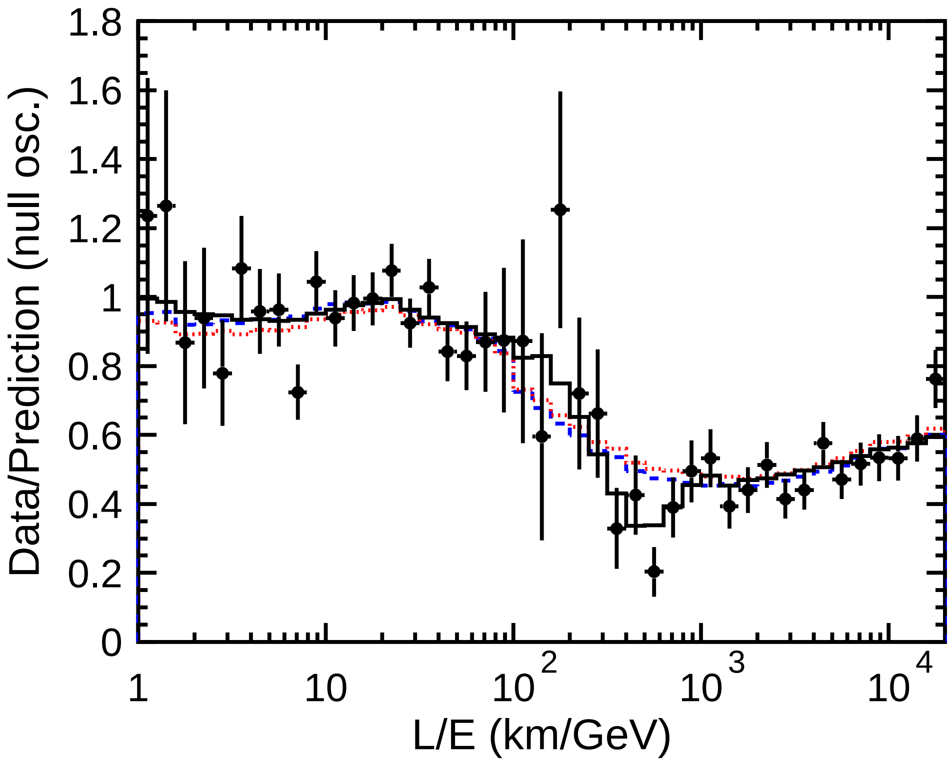
- Summary

Oscillation as leading mechanism

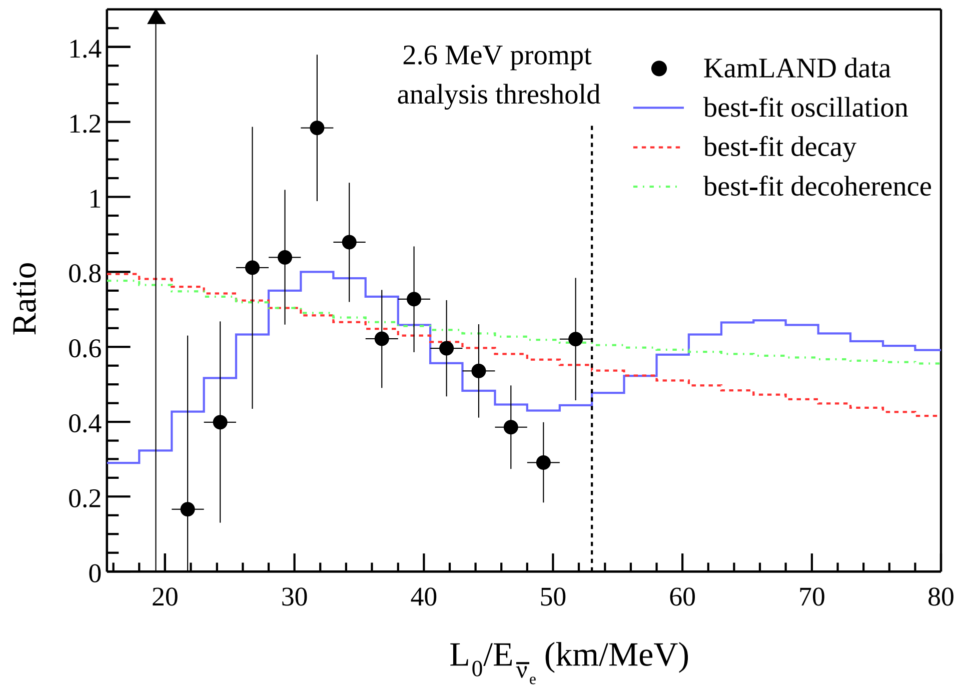
Super-Kamiokande L/E analysis:



Super-Kamiokande collaboration, Phys. Rev. Lett. **93**, 101801 (2004), `hep-ex/0404034`

Oscillation as leading mechanism (2)

KamLAND L/E analysis:



KamLAND collaboration, Phys. Rev. Lett. **94**, 081801 (2005), `hep-ex/0406035`

Sub-leading effects

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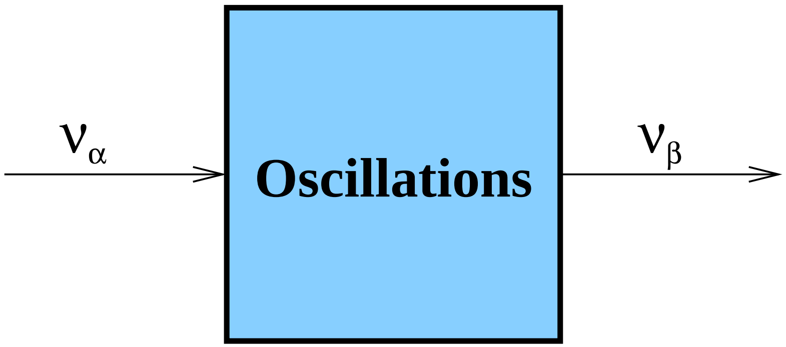

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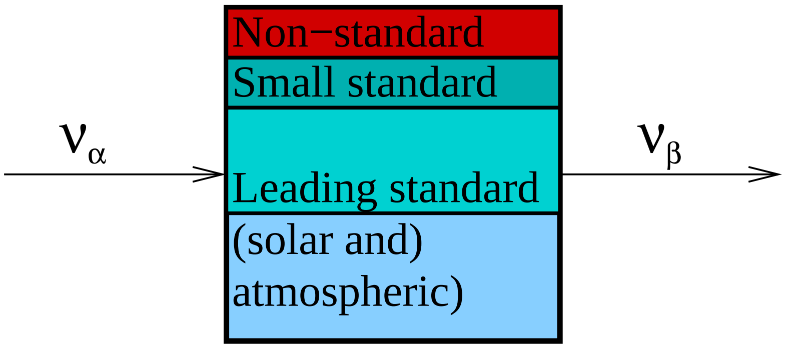

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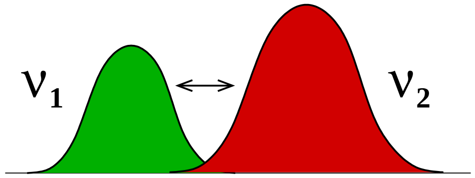

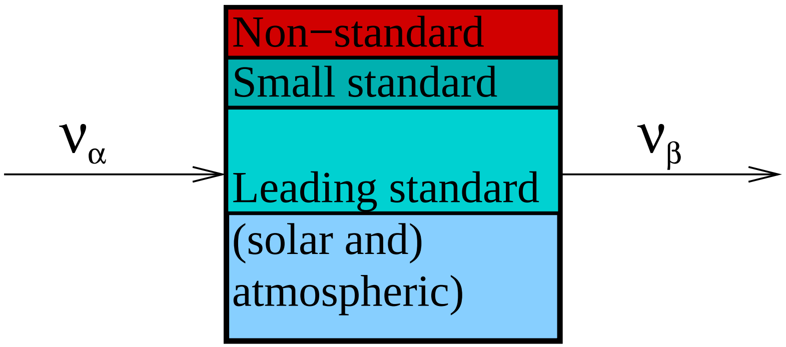

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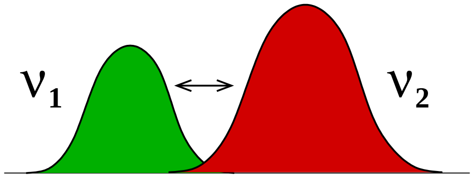

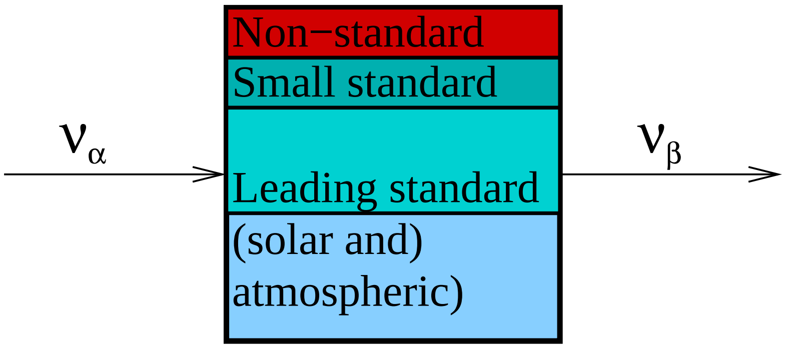

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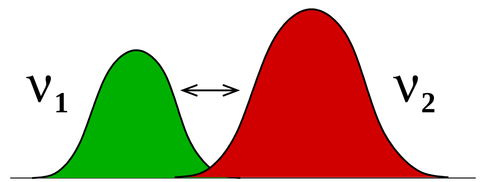

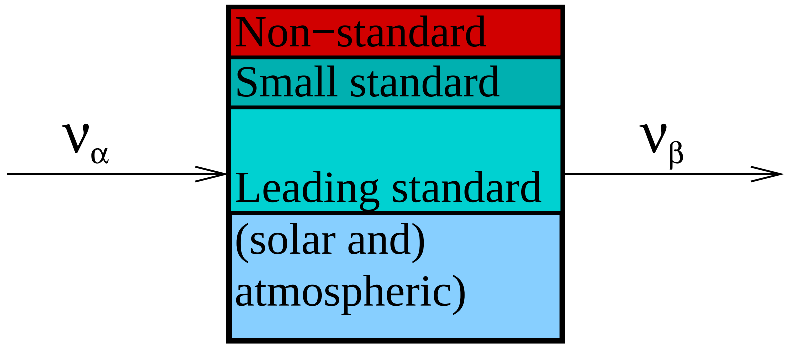

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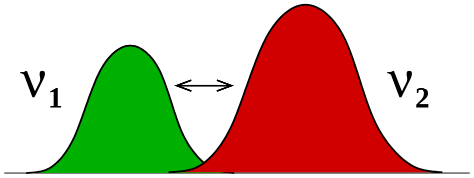

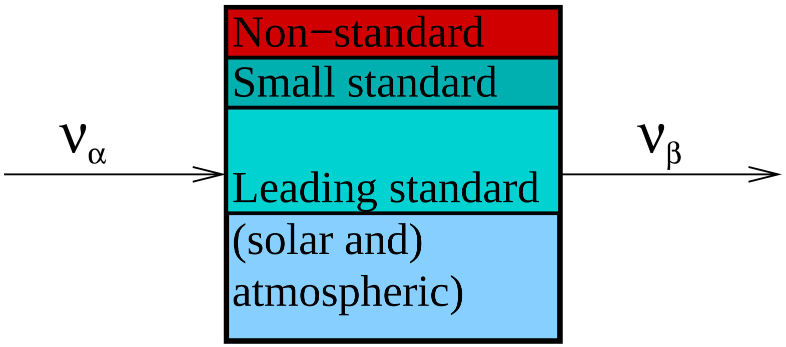

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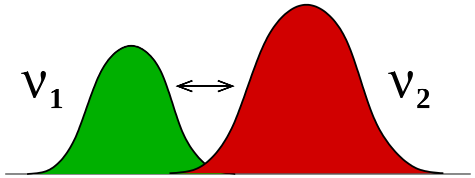

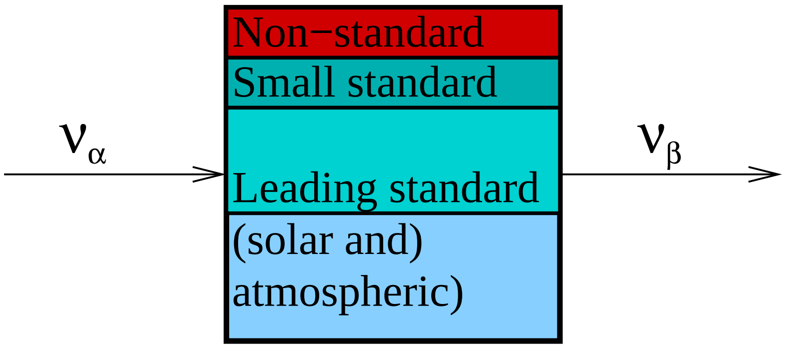

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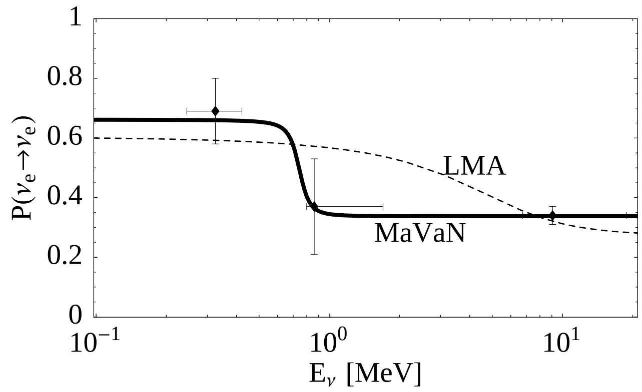
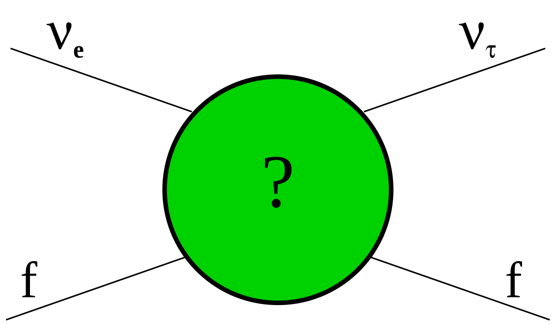


Barger, Huber, Marfatia, Phys. Rev. Lett. **95**, 211802 (2005)



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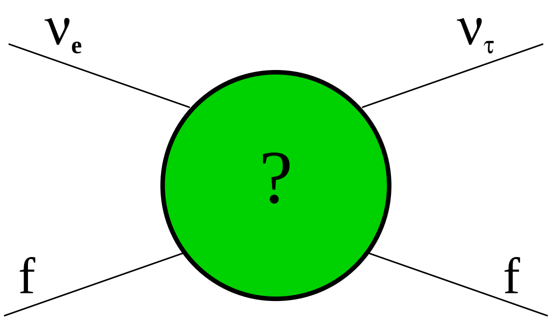
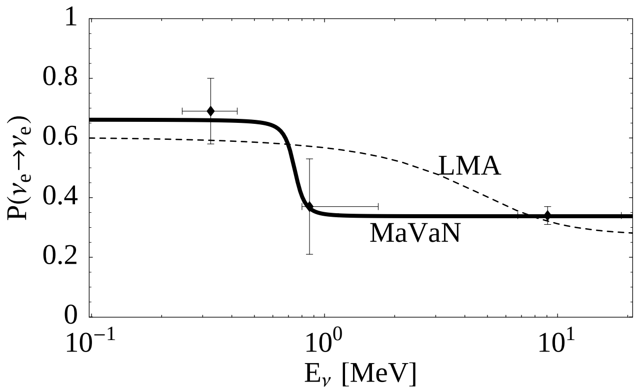
See talk by Friedland.





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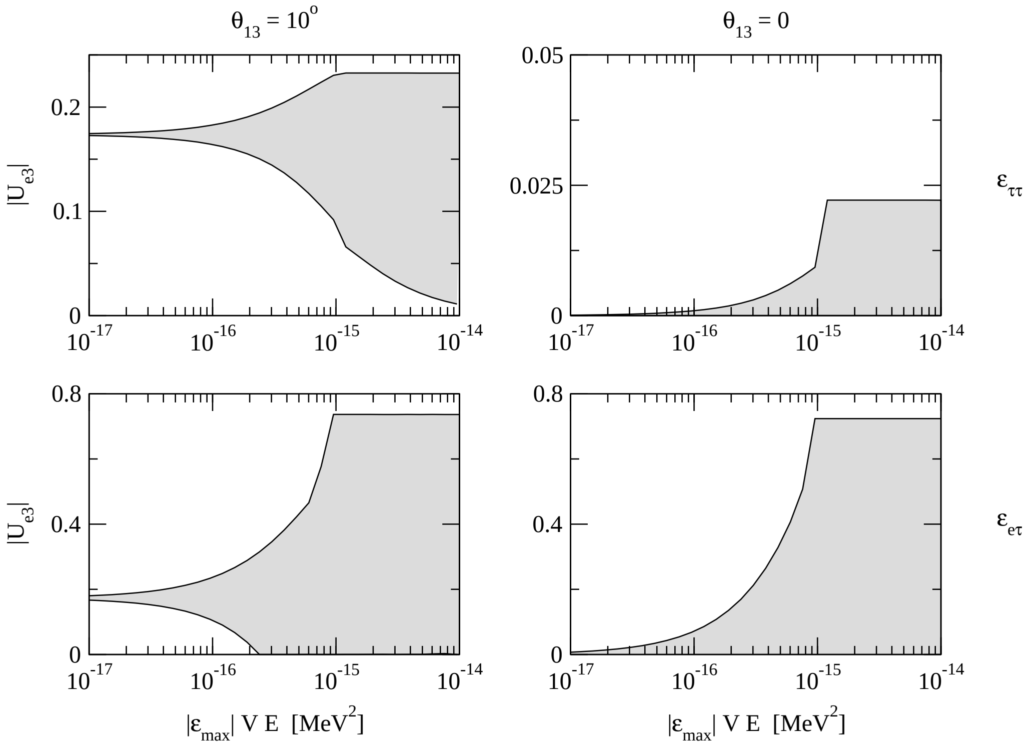
What NSI can do to U_{13}



MB, Ohlsson, Winter, `hep-ph/0508175`

See also:

Huber, Schwetz, Valle, Phys. Rev. **D66** 113006 (2002), `hep-ph/0202048`

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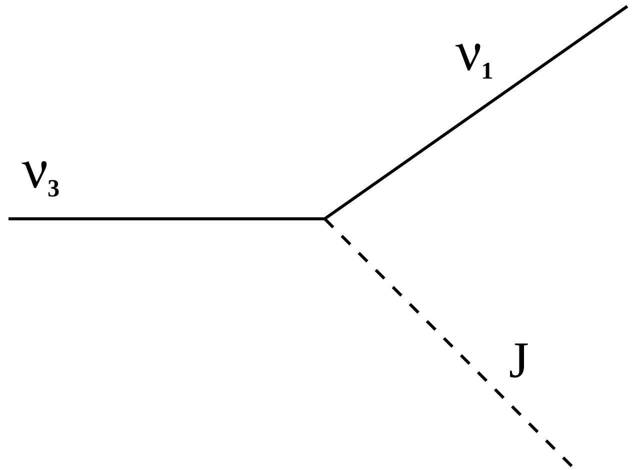

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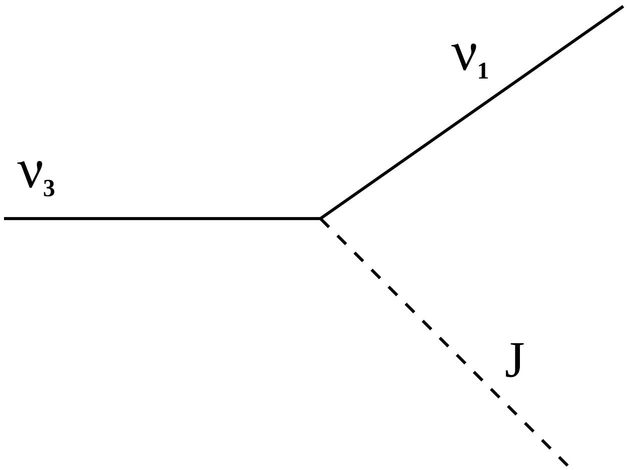
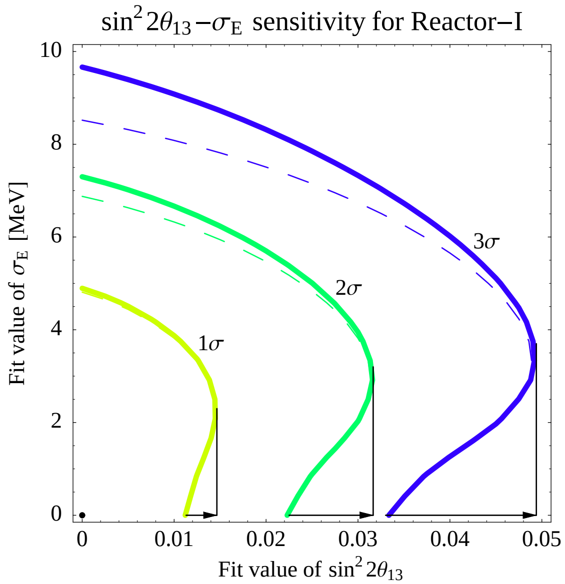
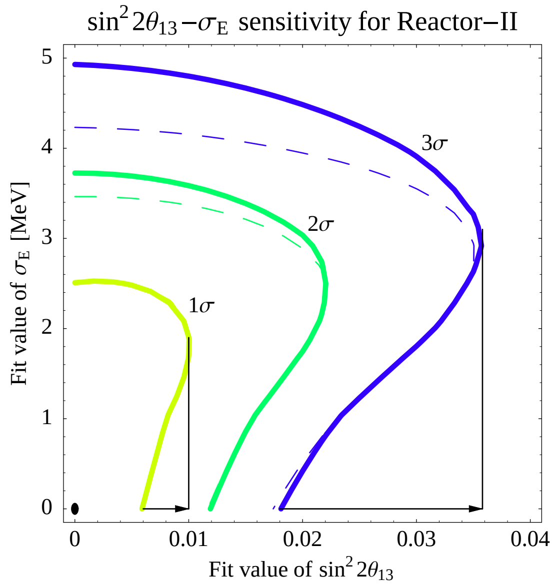


Suppressing θ_{13}

- The result of including the wave-packet decoherence parameter at a fictive two-detector reactor experiment:





MB, Ohlsson, Winter, JHEP **0506**, 049 (2005)

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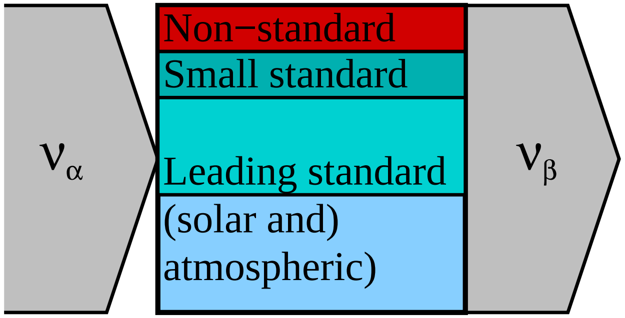
- Amongst coherent effects, one can try to establish if the effects have a “simple” form in flavor or mass basis in order to probe the nature of the effect
- Incoherent effects can be probed mainly through their energy dependence

Telling effects apart (2)

- Effects can also be considered as probability conserving ($\sum P_{\alpha\beta} = 1$)



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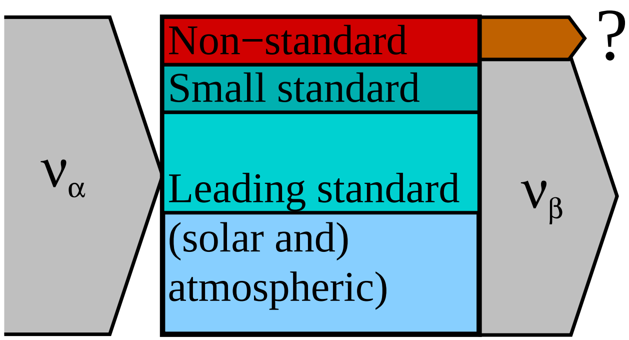
- Effects can also be considered as probability conserving ($\sum P_{\alpha\beta} = 1$) or non-conserving ($\sum P_{\alpha\beta} < 1$)



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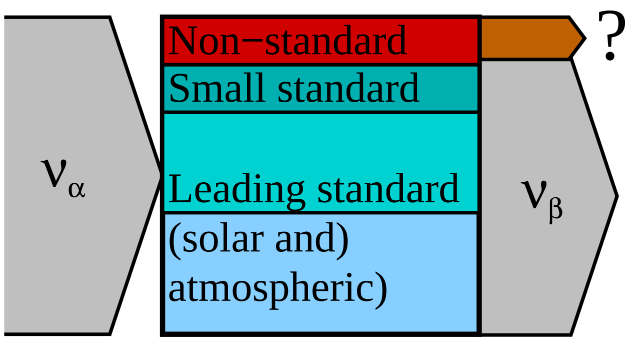
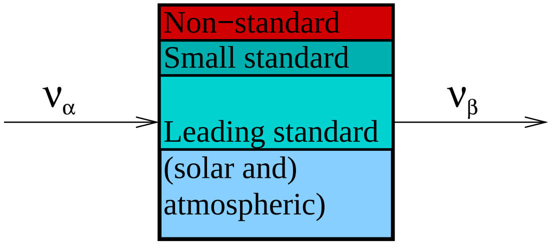


- Coherent effects are always probability conserving while incoherent effects can be either probability conserving ("decoherence-like") or probability non-conserving ("decay-like")

Summary and conclusions

- Neutrino oscillations as main mechanism for flavor conversion



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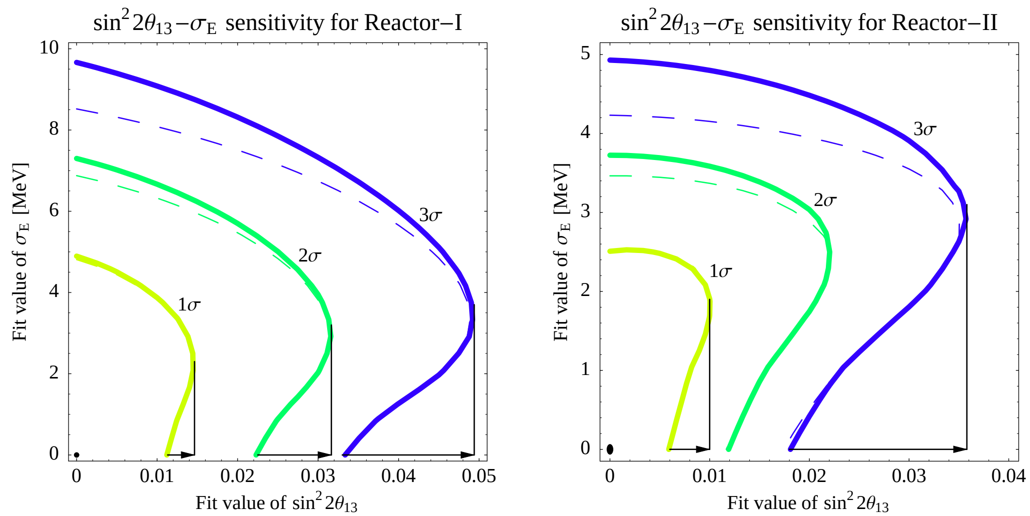

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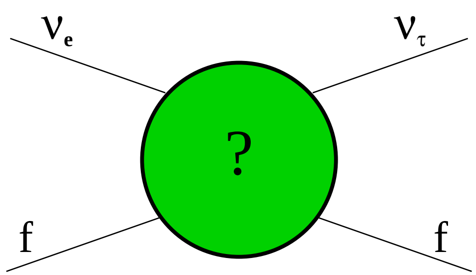

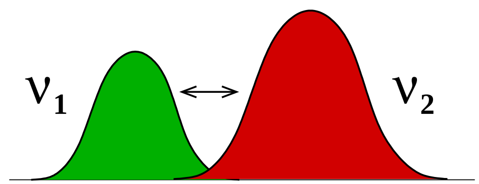

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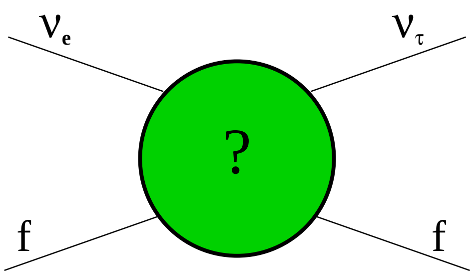
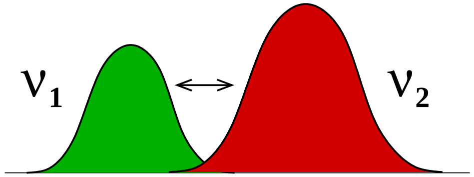


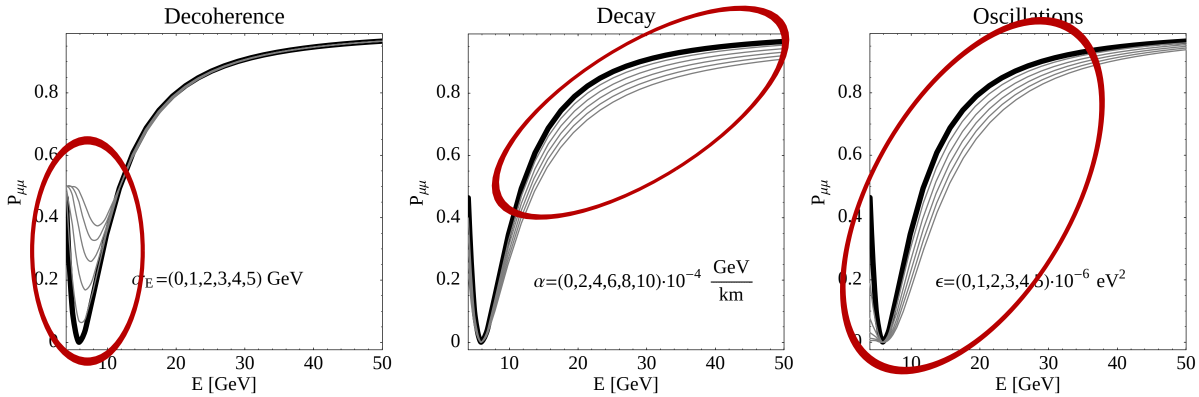


- Given different possible effects, how do we distinguish them from each other?

Backup slides

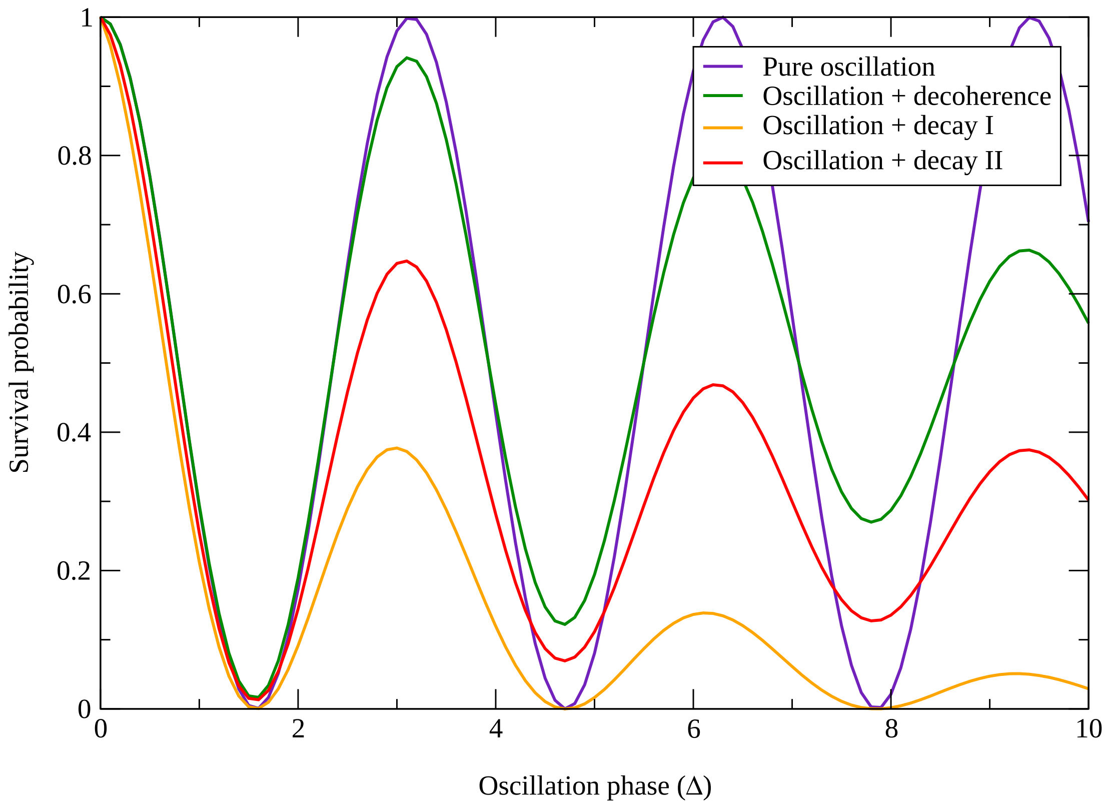
What type of effect?

- How to identify the specific effect?
- Baseline length fixed – no information on β
- Energy dependence is a better candidate
- For a neutrino factory with $L = 3000$ km:



Damped probabilities (2f)

The effect of damping on the neutrino survival probability $P_{\alpha\alpha}$:



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