MAGIC BASELINE BETA BEAM

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Sanjib Kumar Agarwalla, Sandhya Choubey, and Amitava Raychaudhuri, hep-ph/0610333

Sanjib Kumar Agarwalla, Amitava Raychaudhuri, and Abhijit Samanta, hep-ph/0505015

The "Golden Channel" ($\nu_e \rightarrow \nu_\mu$)

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- $\alpha = \Delta m^2_{21}/\Delta m^2_{31}$, $\hat{A} = A/\Delta m^2_{31}$
- $\Delta = \Delta m^2_{31}L/4E$, $A = \pm 2\sqrt{2}G_F n_e E$
- A is positive for neutrinos
- A is negative for antineutrinos

Cervera *et al.*, hep-ph/0002108

Freund, Huber, Lindner, hep-ph/0105071

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- This dependence however brings in the problem of PARAMETER DEGENERACIES

Degeneracies in the Golden Channel

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- $Sgn(\Delta m^2_{31}) - \delta_{CP}$ Degeneracy
- Intrinsic $(\delta_{CP}, \theta_{13})$ Degeneracy

Fogli, Lisi, hep-ph/9604415

Minakata, Nunokawa, hep-ph/0108085

Burguet-Castell, Gavela, Gomez-Cadenas, Hernandez, Mena, hep-ph/0103258

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- **Degeneracies create Clone Solutions**

Killing the Clones at The Magic Baseline

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$$\sin(\hat{A}\Delta) \simeq 0$$

$$\Rightarrow$$

$$L_{magic} \simeq 7690 \text{ km}$$

Barger, Marfatia, Whisnant, hep-ph/0112119

Huber, Winter, hep-ph/0301257

Smirnov, hep-ph/0610198

Near-Resonant Matter Effects

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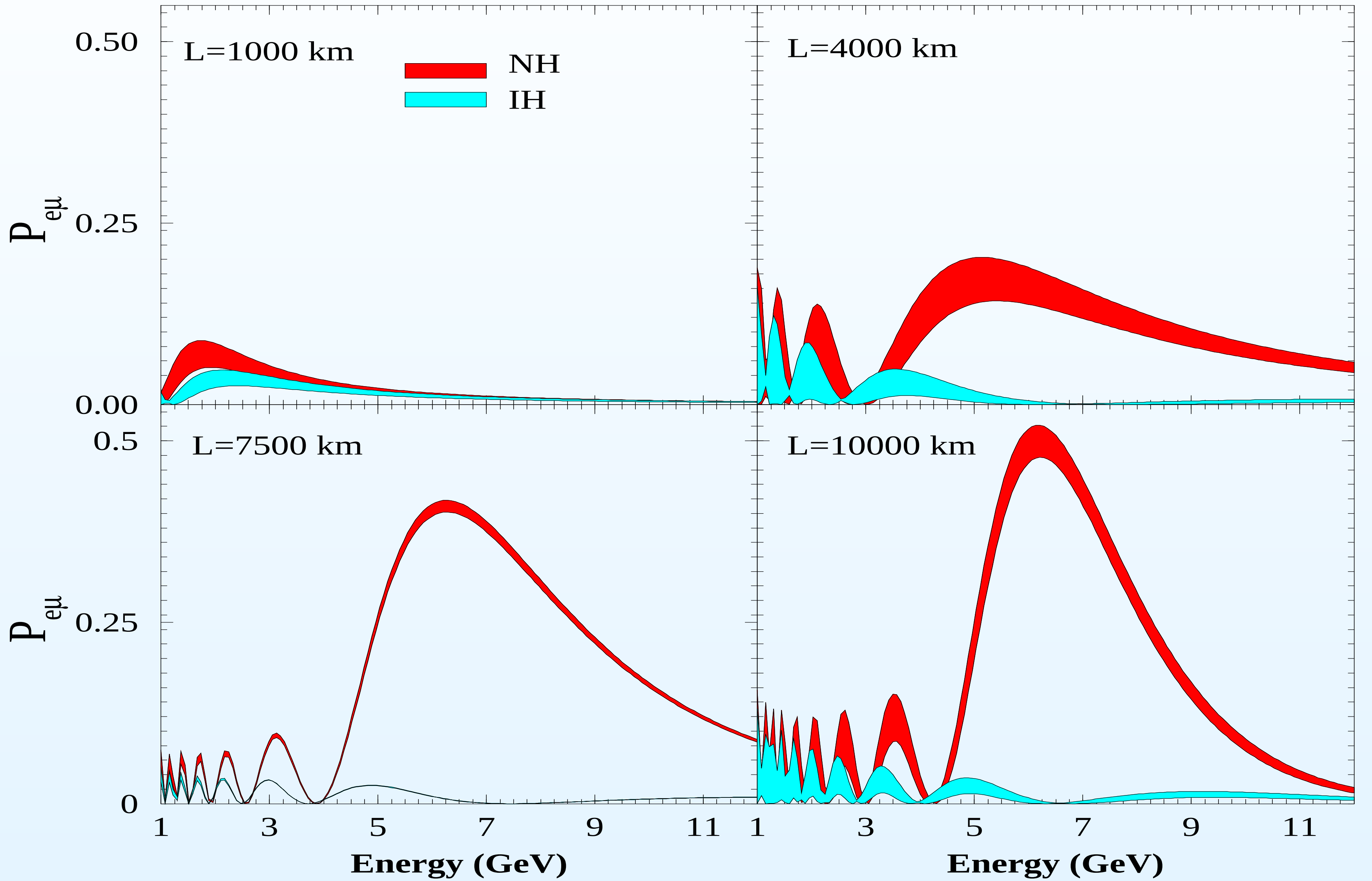
- At the magic baseline, largest matter effects will come when $E \simeq 6$ GeV

The Probability



Agarwalla, S.C., Raychaudhuri, hep-ph/0610333

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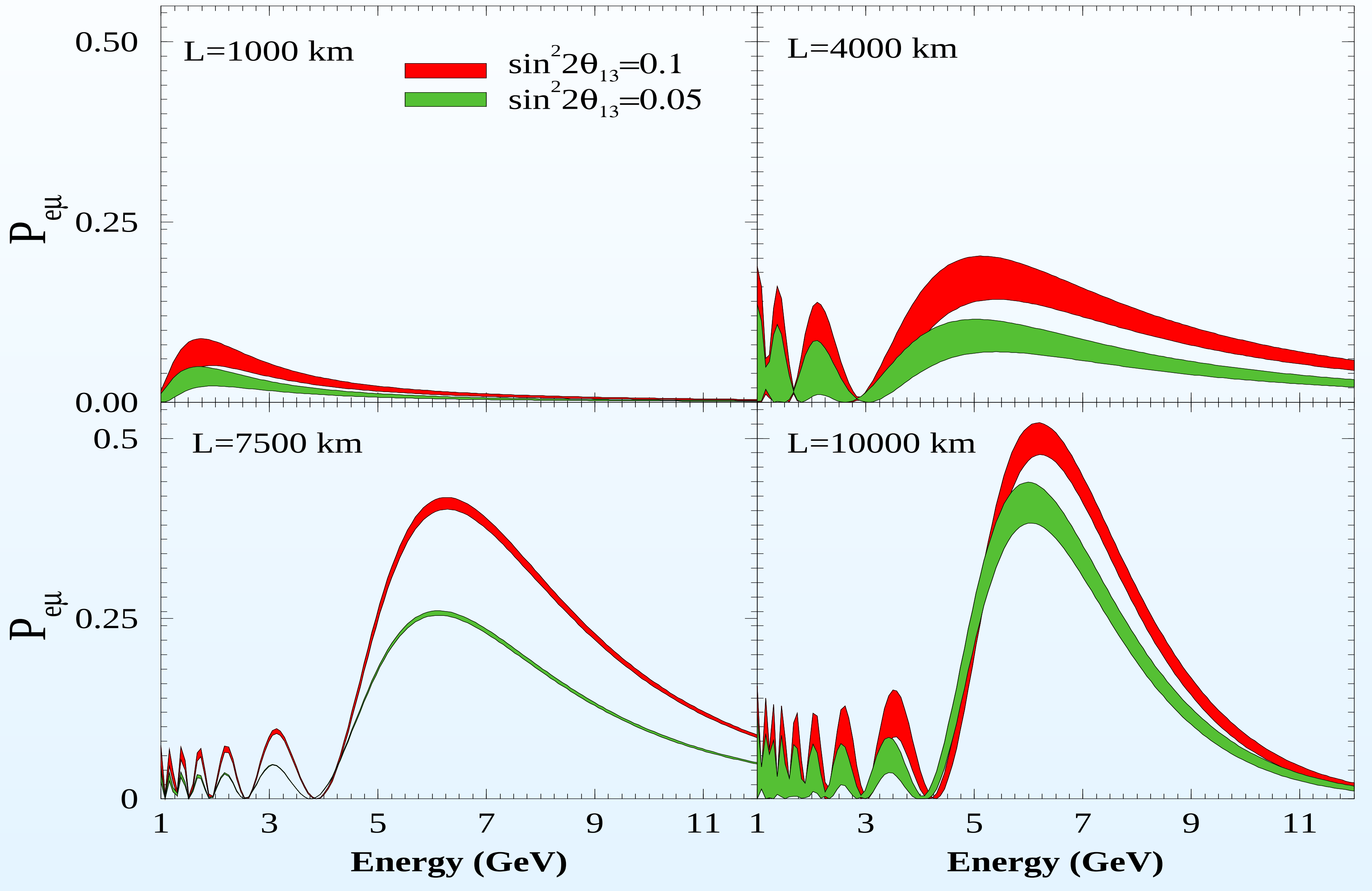

Agarwalla, S.C., Raychaudhuri, hep-ph/0610333

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- So the Beta-Beam itself must be different – it must be a multi-GeV beam and thats good for matter effects!!

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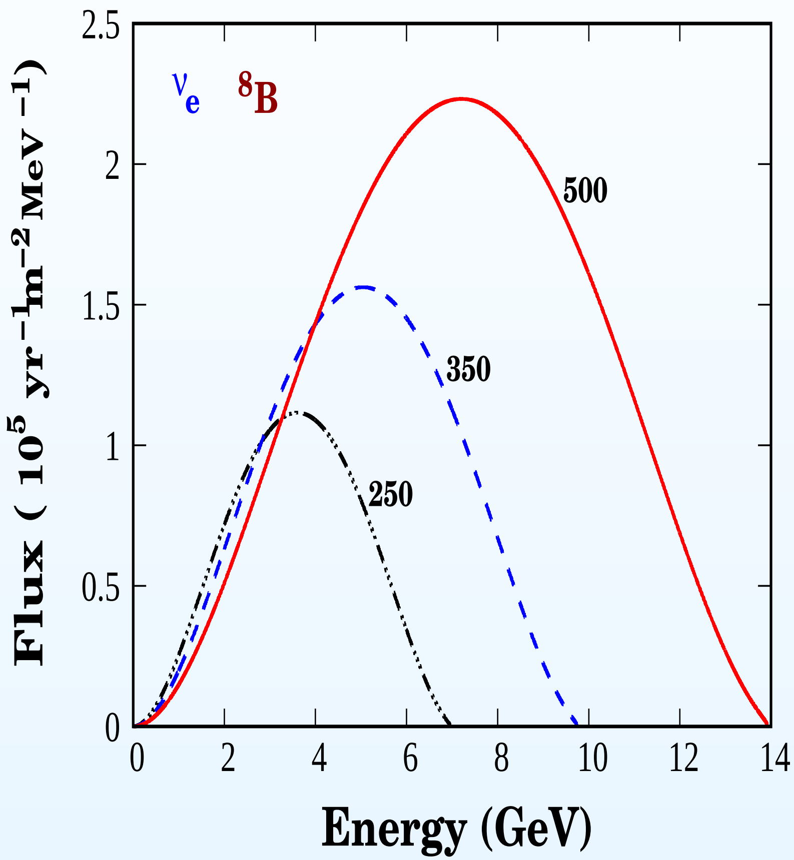
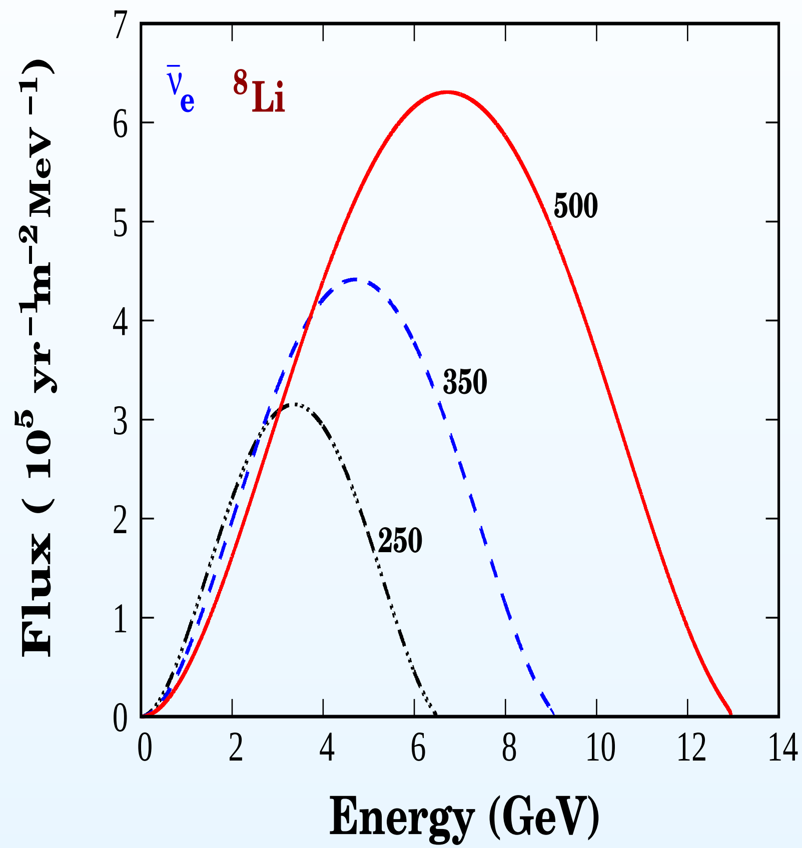
The CERN-INO Beta-Beam Experiment





Agarwalla, SC, Raychaudhuri, hep-ph/0610333

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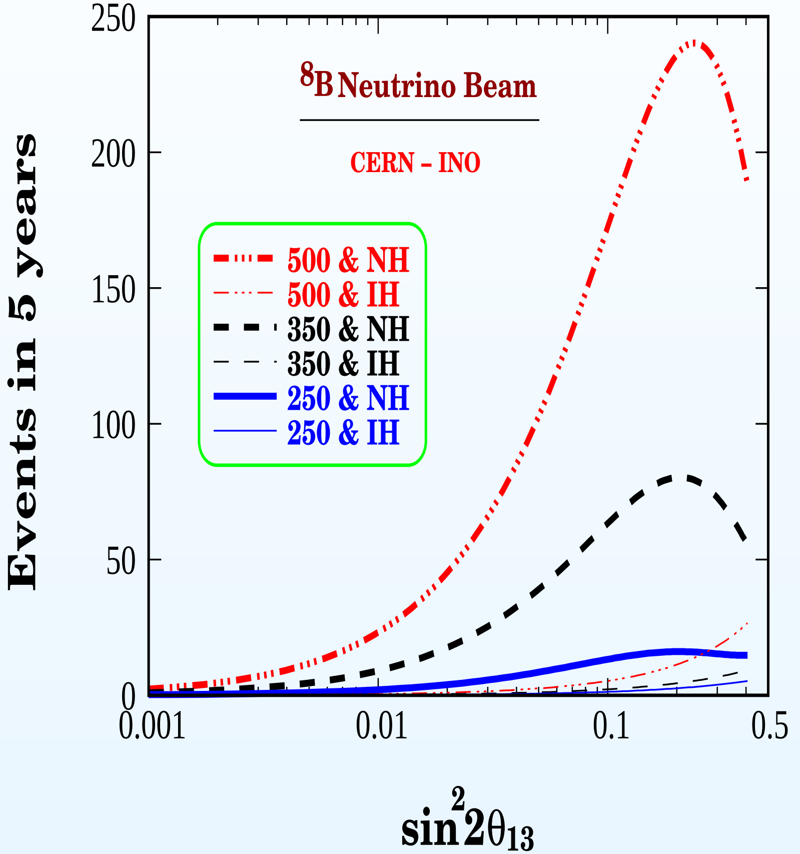

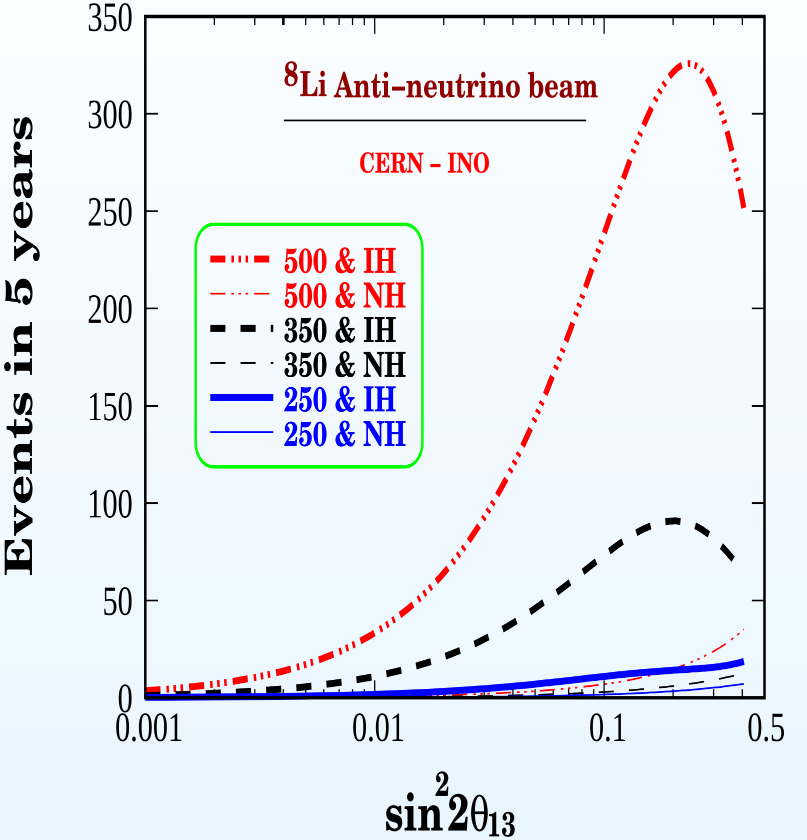

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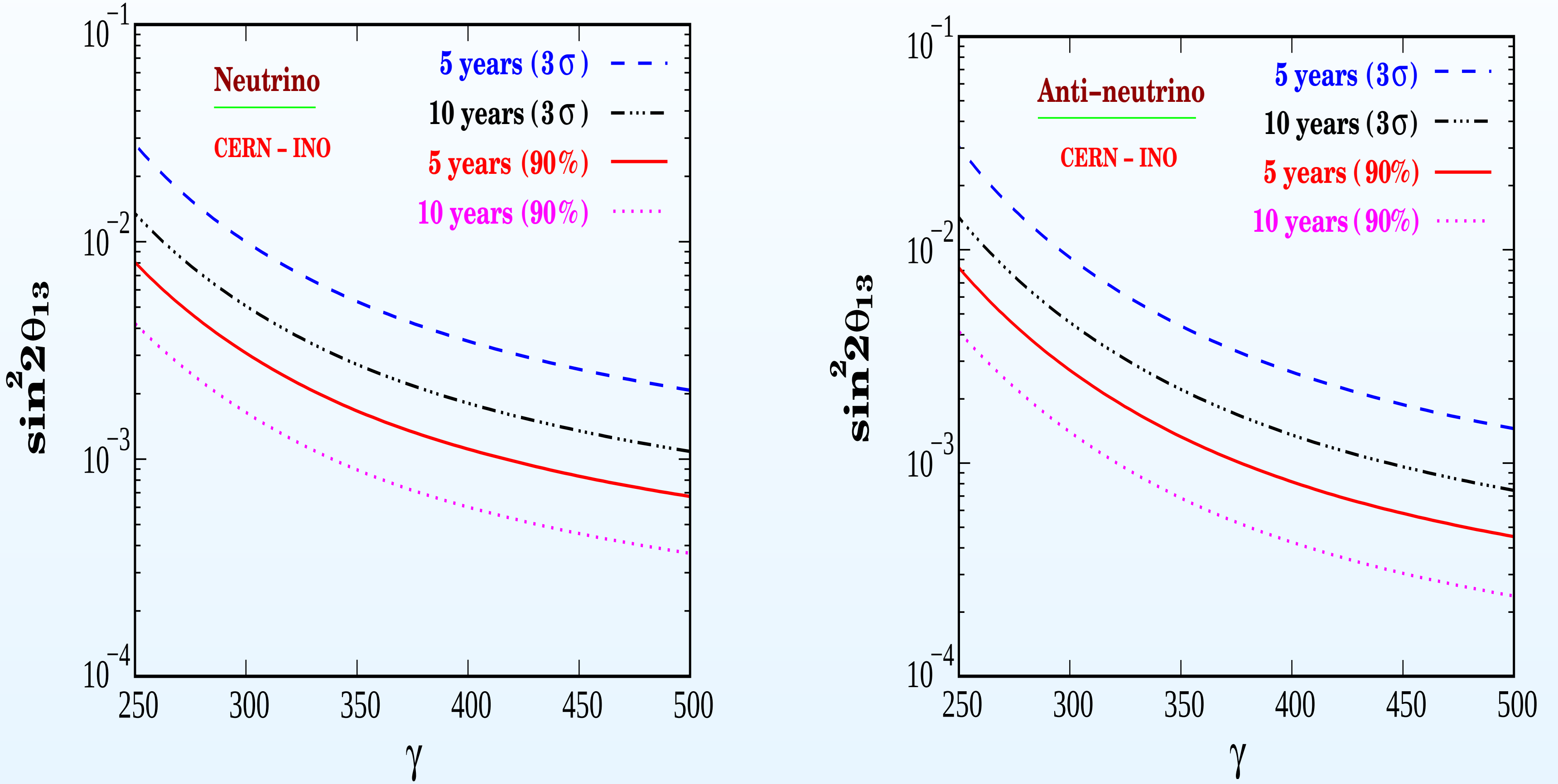
- The rate shows a sharp dependence on the hierarchy and θ_{13}

The CERN-INO Beta-Beam Experiment

- Sensitivity to θ_{13}



Agarwalla, SC, Raychaudhuri, hep-ph/0610333

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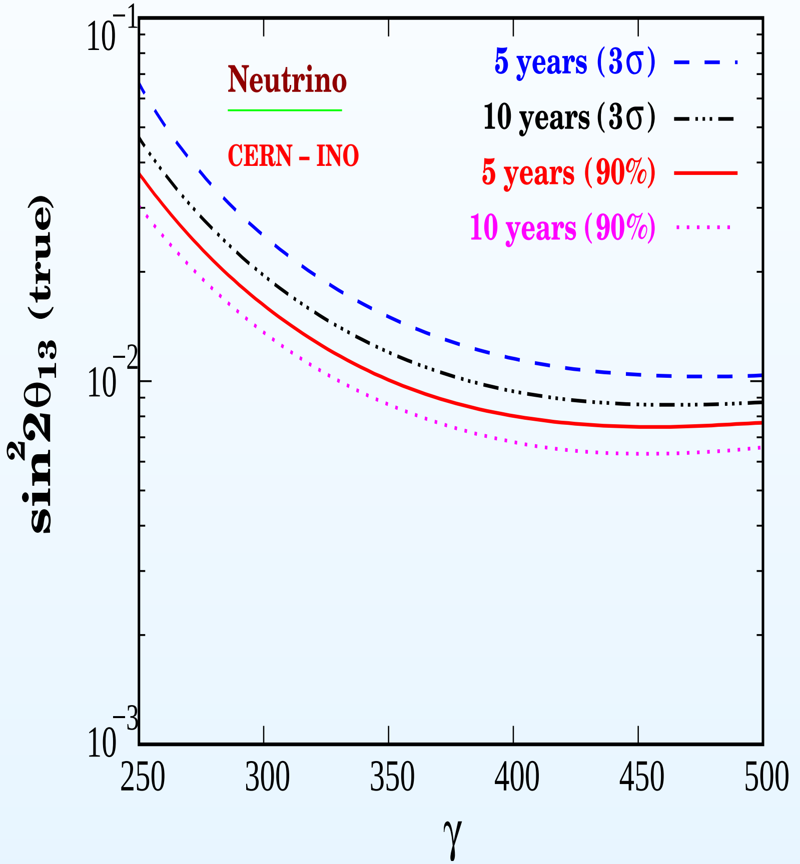
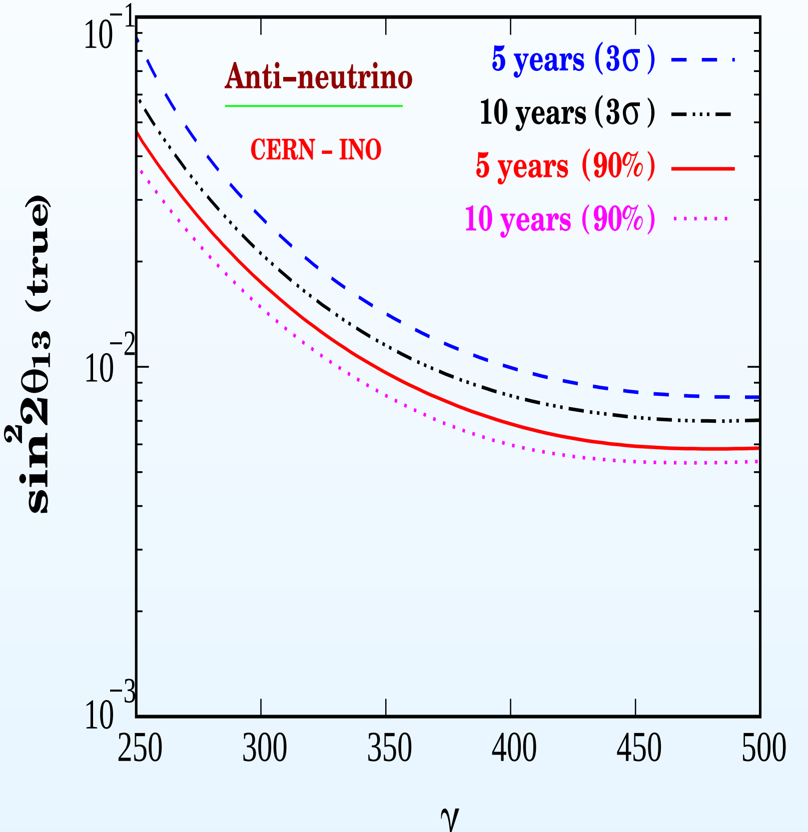
The CERN-INO Beta-Beam Experiment

- Sensitivity to $sgn(\Delta m^2_{31})$





Agarwalla, SC, Raychaudhuri, hep-ph/0610333

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- Near-resonant matter effect gives largest possible $P_{e\mu} \Rightarrow$ enough statistics even though flux is smaller since its a Beta-Beam at 7152 km.
- The CERN-INO Beta-Beam experiment (Beta-INO) is expected to give sensitivity to θ_{13} and $sgn(\Delta m^2_{31})$ better than all other rival proposals, apart from a high performance neutrino factory.