

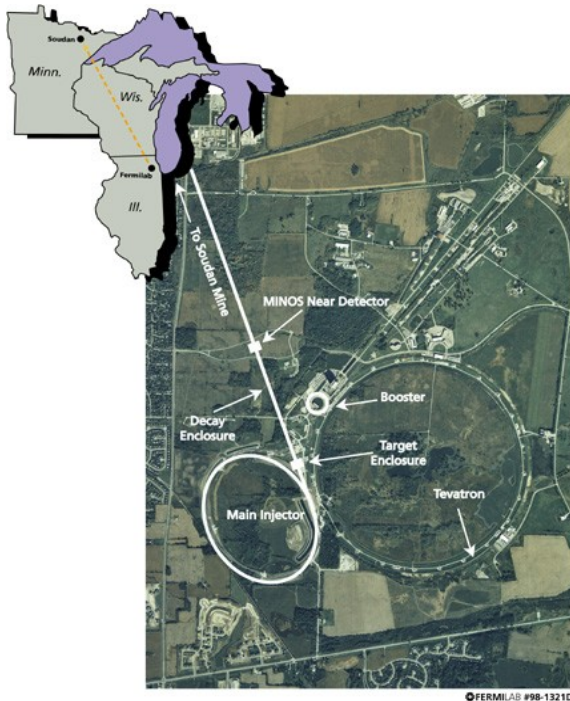
# Neutrino Experiment Updates from the April APS Meeting

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# Outline

- Experiment Updates
  - MINOS
  - MiniBoone
  - Double CHOOZ
  - Daya Bay
  - SNO
  - Borexino
  - Beta Decay
- PAMELA vs Fermi (briefly)
- Some Advice on Future Careers for Grad Students

# MINOS

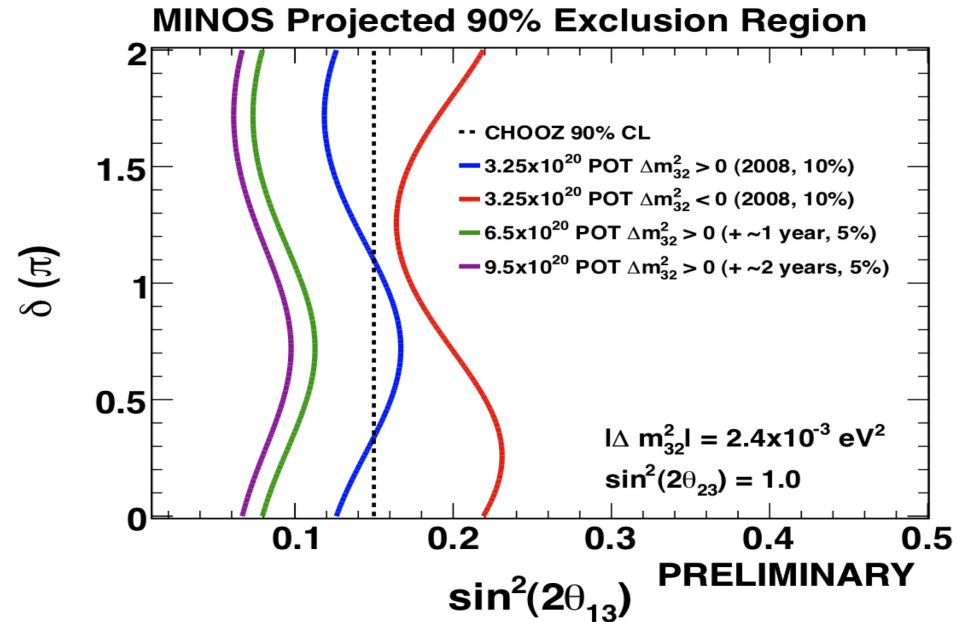
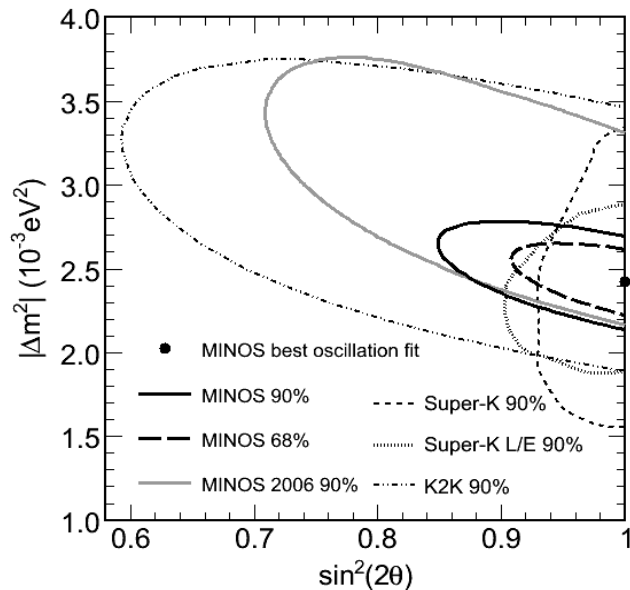


- Generate  $\nu_\mu$  and  $\nu_e$  by sending protons to a target.
- Near and Far detectors (functional identical)
- Steel plates interwove with scintillators in a magnetic field.

- Measured  $\theta_{23}$  through  $\nu_\mu$  disappearance and have set a limit for  $\theta_{13}$  through  $\nu_e$  appearance ( $\sin^2 2\theta_{13}$  less than 0.15 with large MC errors).

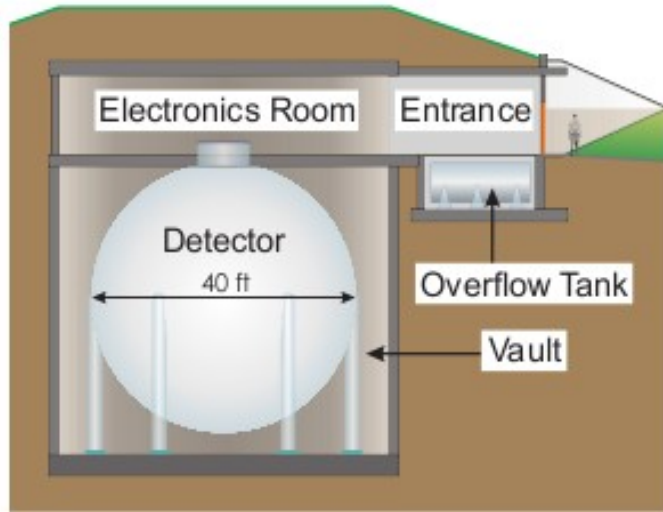


# MINOS



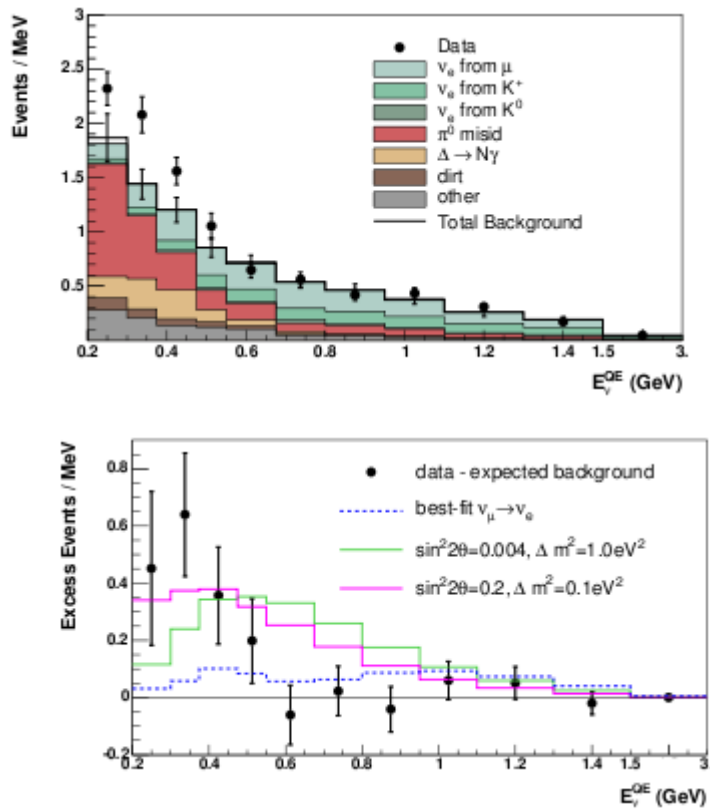
- From  $3.2 \times 10^{20}$  protons on target, are now looking at dimuon decays (from charm or strange particles created in CC reactions), anti  $\nu_\mu$  and anti  $\nu_e$  from beam contamination (about 6%), and  $\nu_\mu$  to  $\nu_\tau$ . Currently not enough data to suggest anything.

# MiniBoone

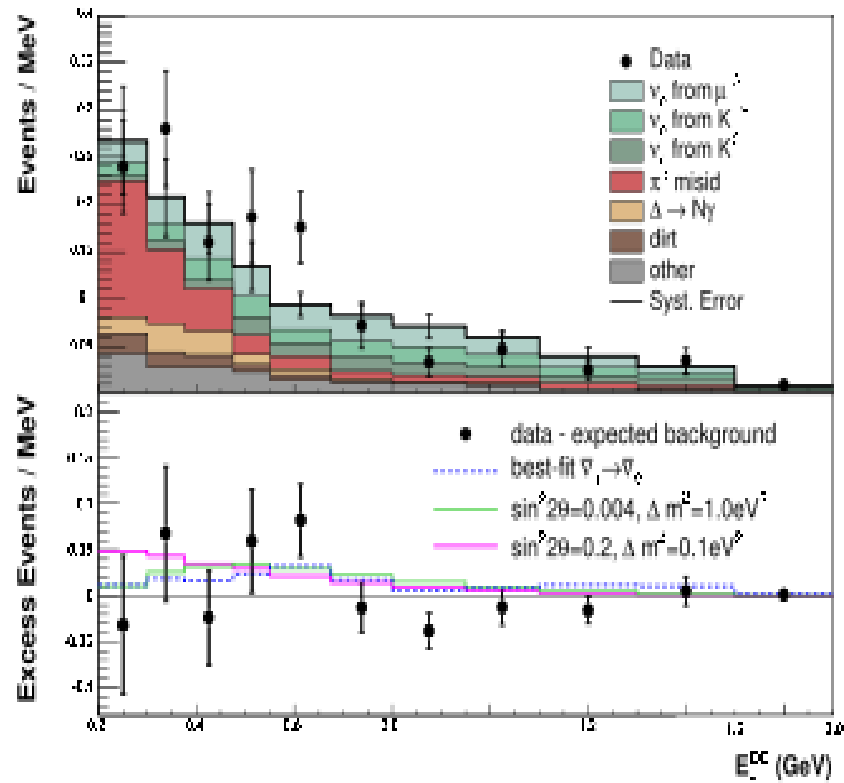


- Scintillator detector designed to look for sterile neutrinos similar to LSND.
- Looked at oscillation from  $\nu_{\mu}$  to  $\nu_{e}$ .
- Did not find them, but have a low energy excess in neutrino reconstructed energy.
- Still unknown as to why.
- Have now run in anti- $\nu$  mode and preprint suggests there is no excess in low energy (results were not given at APS) and both modes appear similar.

# $\nu_e$ Compared to anti- $\nu_e$

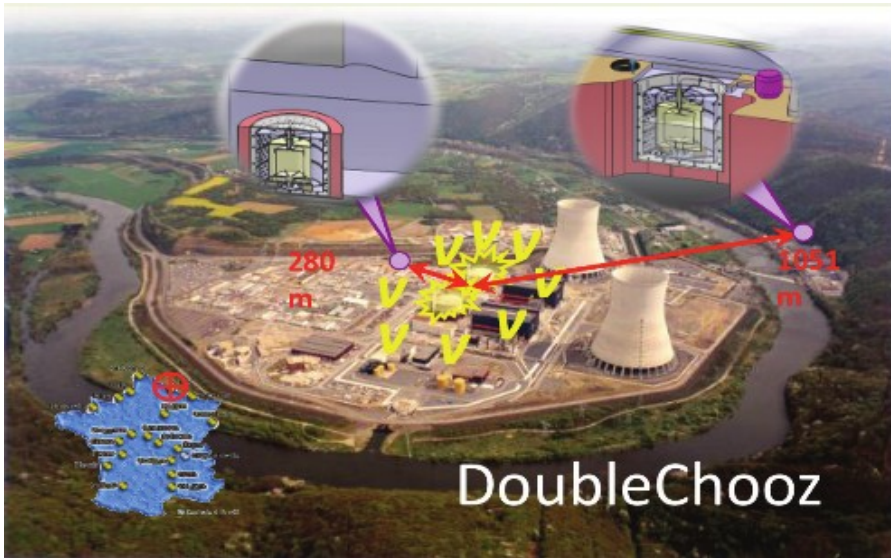


$\nu_e$   
arXiv:0812.2243

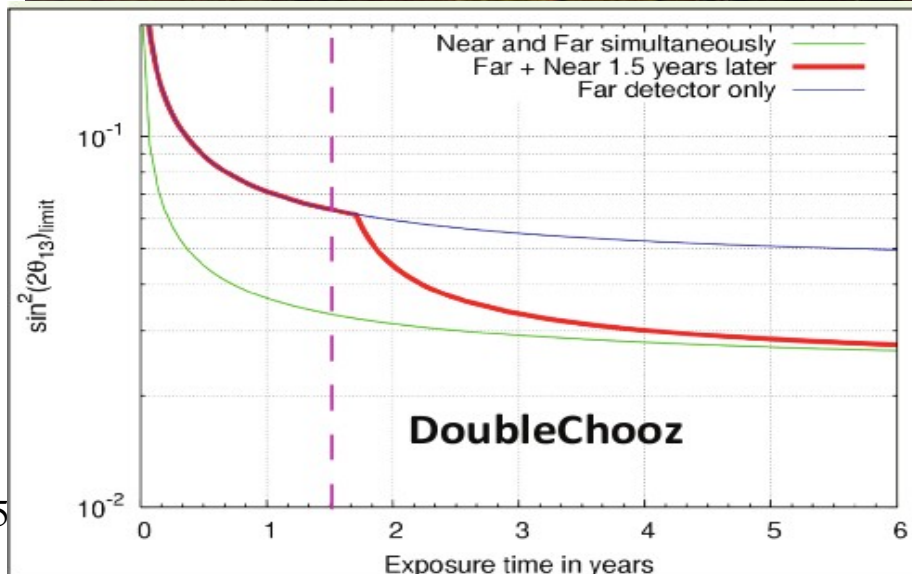


anti- $\nu_e$   
arXiv:0904.1958

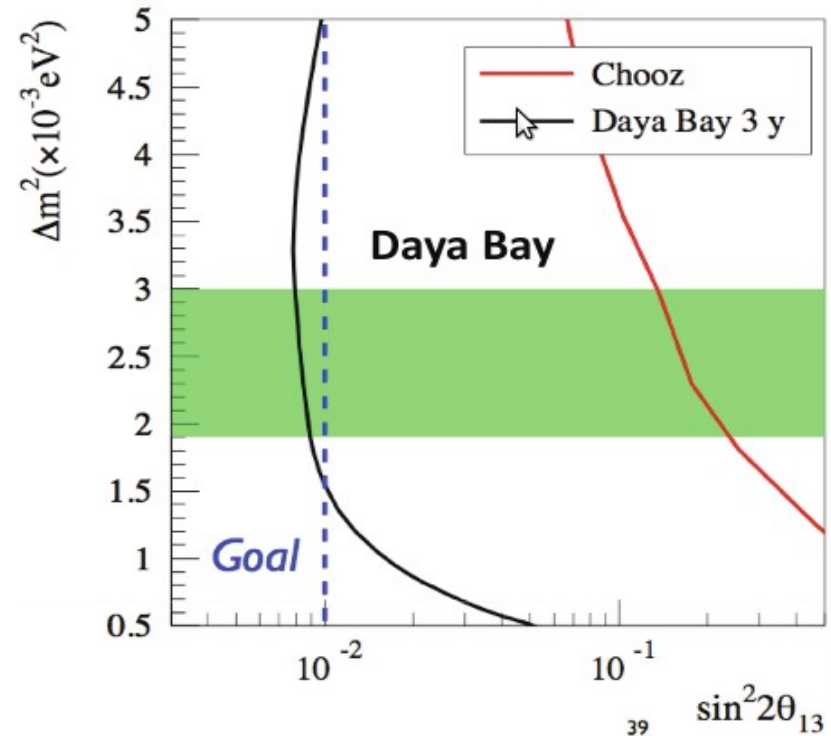
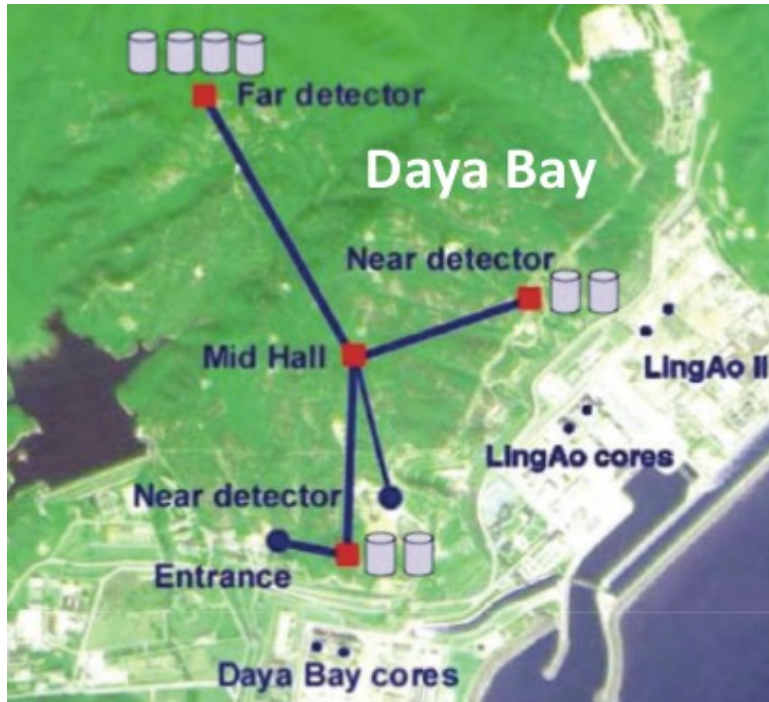
# DoubleChooz



- Look for  $\theta_{13}$  through  $\nu_e$  disappearance
- Reactor flux was originally the largest error
- Near/Far detector eliminate.
- Scintillator with several veto systems.
- Far detector will start in middle 2010 and Near at the end of 2011.

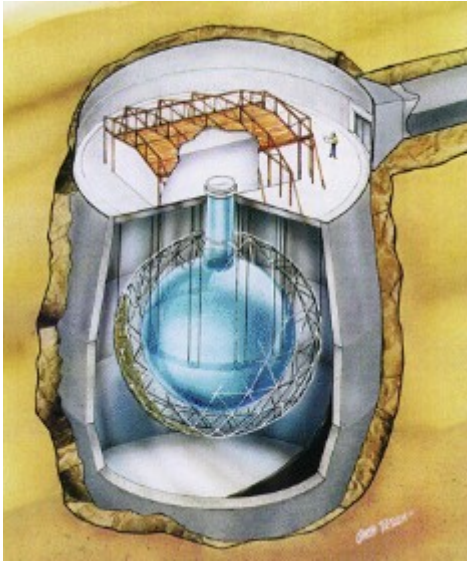


# Daya Bay



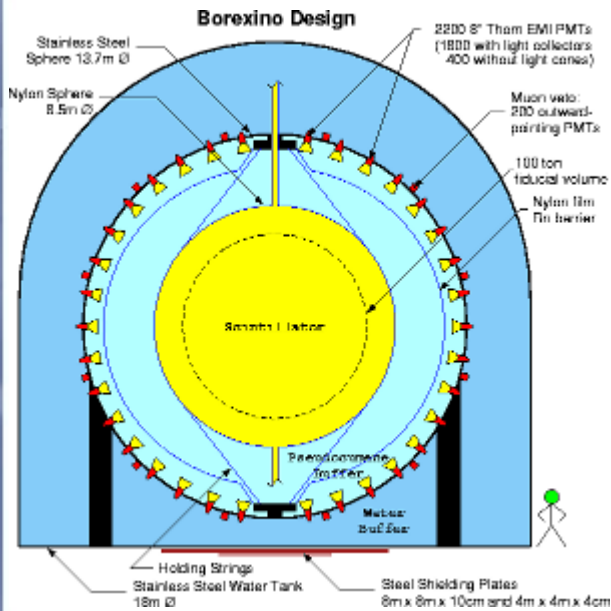
- Similar to DoubleChooz except for multiple near detectors and multiple detectors at each site.
- Excavation of Near Hall and tunnels in progress. Expect to start operation summer of 2011.

# SNO



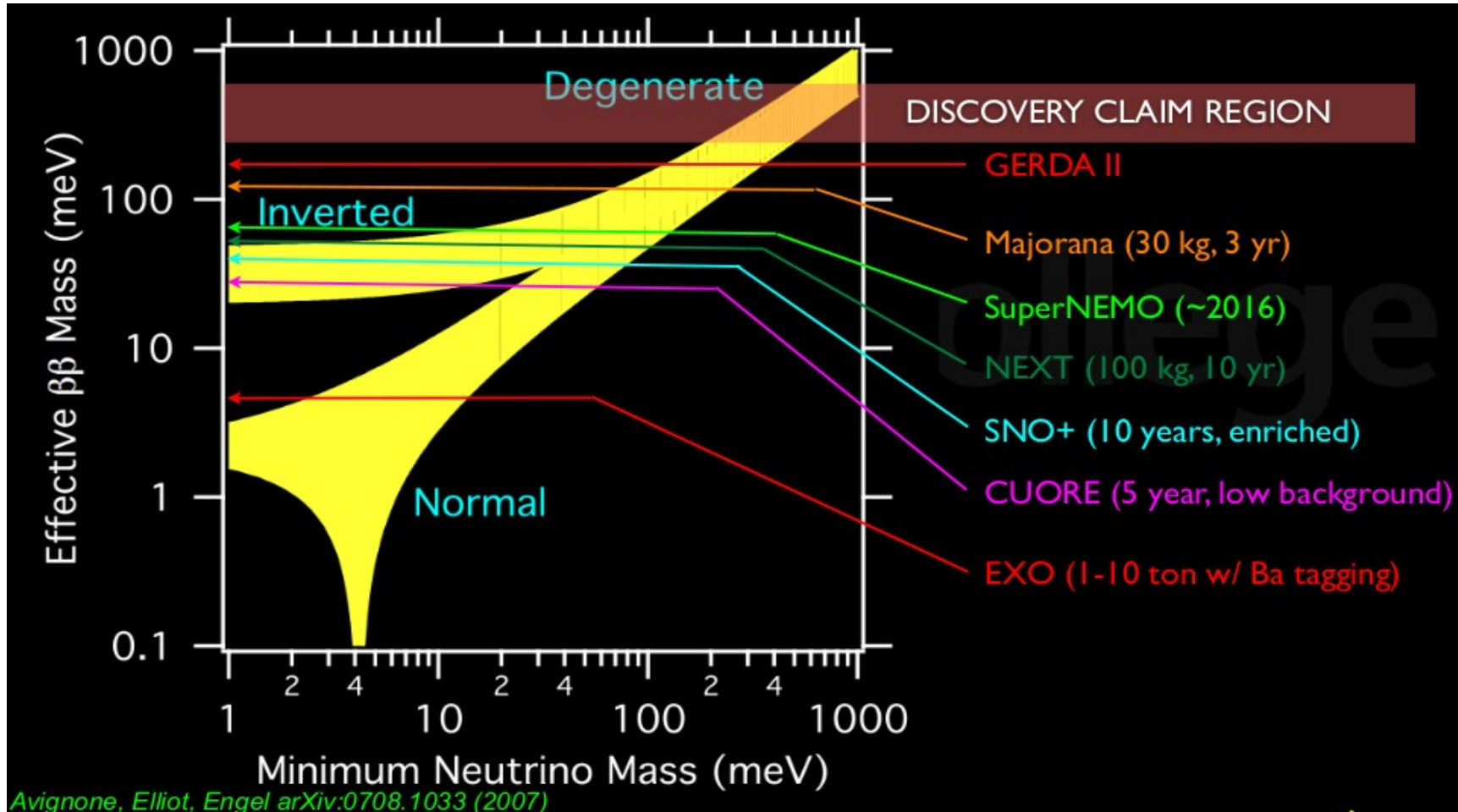
- Heavy Water detector to observe NC and CC events.
- Now working on Analysis using all phases of data (salt etc...)
- Working on looking at lower energy data, although expected background will be much higher.
- No results released as of yet.

# Borexino

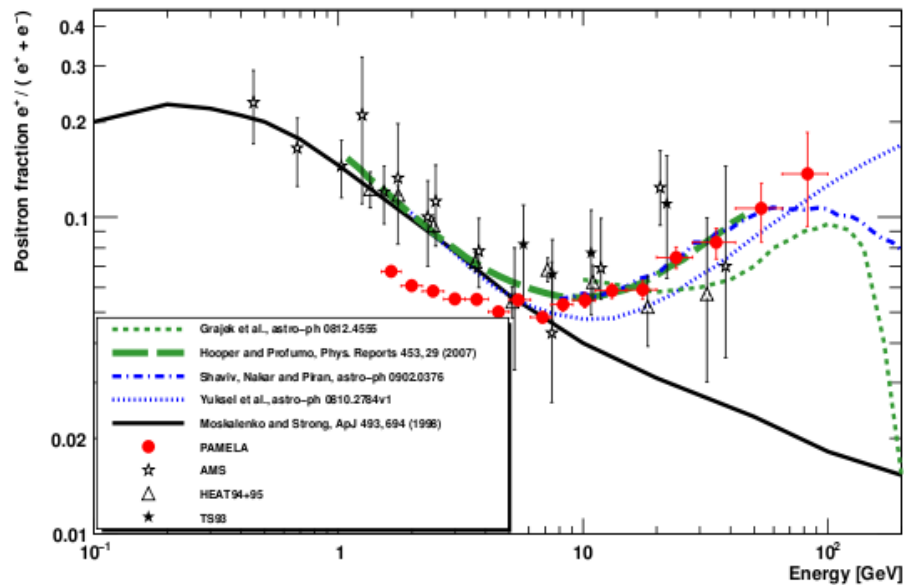


- Looked at solar neutrino flux from  $^7\text{Be}$ .
- Measured  $49 \pm 3(\text{stat}) \pm 4(\text{sys})$  per day per 100 tons
- MSW-LMA MC predicts  $48 \pm 4$ .
- Plan to start looking for CNO neutrinos.
- New solar models predict 30-50% less due to higher core metallicity.
- Funding in 2009 and start taking data in 2011.

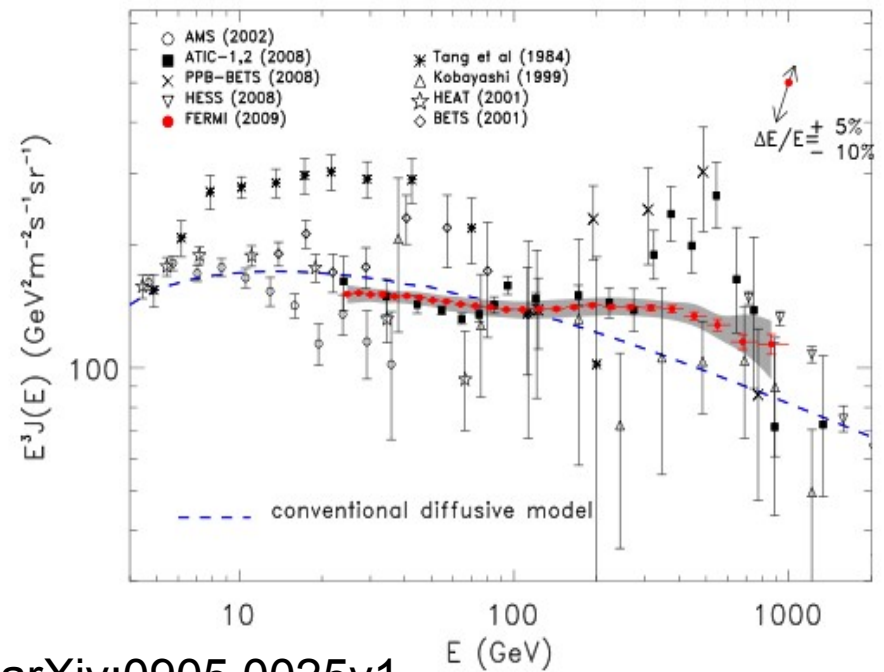
# Beta Decay Experiments



# PAMELA vs Fermi



arXiv:0905.2551v1



arXiv:0905.0025v1

PAMELA sees an excess of positrons compared to conventional theory (but not anti protons). Fermi sees a slight increase of electrons compared.

# Career Advice for Students

- Academia
  - About 400 faculty vacancies per year vs 1400 new PhDs per year in the US.
  - Teaching/Research Universities have different criteria.
  - High competition and networking needed.
- Industry
  - Most jobs are by “word of mouth”.
  - Need to emphasize skills.
  - Find out what a company needs and sell oneself.

# Conclusions

- In the “calm before the storm”.
- Most experiments are in pre/construction phases.
- 2011-2012 will be the start of massive data collecting with a large number of results in 3-5 years afterwards.
- Some experiments (MINOS/MiniBoone) will continue running and will have new data sooner.
- Can now start shifting through older data for more exotic interactions.