Working Group Three

Non-Oscillation Neutrino Physics: Physics and Detector

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Role of Non-Oscillation ν Physics

- Exploit exponential growth of ν

Beam	$\langle E_\nu \rangle$ [GeV]	ν flux per year
NuTeV/CCFR	100	$\sim 10^{14}/\mathrm{m}^2$
CHORUS/NOMAD	30	$\sim 3 \times 10^{15}/\mathrm{m}^2$
MINOS Near LE	5	$\sim 3 \times 10^{16}/\mathrm{m}^2$
MINOS Near HE	15	$\sim 10^{17}/\mathrm{m}^2$
Neutrino Factory†	12	$\sim 5 \times 10^{19}/\mathrm{m}^2$

†$\sim 2 \times 10^{20} \mu$/yr, 20 GeV

- Provide understanding of neutrino interactions crucial for oscillation physics
  - ↪ Measure low-energy neutrino cross-sections (superbeams)
  - ↪ Understand far detector response
  - ↪ Measure backgrounds to oscillation searches
    - ⋆ CP violation searches will almost certainly be limited by these!

Physics of ν Interactions

- QCD Studies with Neutrinos
  - ↪ Huge fluxes allow weaning of neutrinos experiments from massive targets
    - ⋆ Low Z targets: nuclear dependence, separate νp, νn
    - ⋆ *Polarized* targets: flavor spin SFs
  - ↪ Discussions at NUFACT 2002:
    - ⋆ Nuclear effects: experiment (NUMI) and theory (Tuesday am)
    - ⋆ Status and Prospects for polarized and unpolarized nucleon SFs (Tuesday noon, pm)
    - ⋆ Higher Twist effects, low Q^2 QCD (Wednesday, am and noon)
    - ⋆ DIS Sum Rules, tests of QCD (Wednesday, am and noon)
- "The NuTeV Train Wreck"
  - ↪ ${\sin^2\theta_W}^{\nu N}$ far off SM expectation
    - ⋆ Physics beyond electroweak? Wacky QCD?
  - ↪ Discussions at NUFACT 2002:
    - ⋆ The measurement (Wednesday pm)
    - ⋆ 'Old and New Physics" interpretations (Wednesday pm)

Near Detectors & ν Oscillations (Joint with Working Group 2)

- Why is this important?
  - ↪ This limits our knowledge *today!*
    - ⋆ π^0 appearance at Super-K $\Rightarrow$ ν_τ?
    - ⋆ LSND+SNO+Super-K$\Rightarrow$'"3+1" scenario, requires $\sim 10\%$ ν_μ disappearance at LSND!
  - ↪ Need for knowledge grows more acute with Superbeam ν oscillation program
- Focus here on (mostly) next-generation Superbeams (sub–few GeV, π beams)
  - ↪ Report from the frontiers: K2K and NUMI (Thursday noon, post-coffee)
  - ↪ Phenomenology of Cross-Sections at Low energy (Thursday noon)
  - ↪ Quasi-elastic and Resonance ν_μ and ν_e detection (Thursday pm)
  - ↪ Fluxes: absolute and far/near ratios (Thursday pm and post-coffee)
  - ↪ Near detectors for cross-section and flux (Thursday post-coffee)