Scientific Assessment Group for Experiments in Non-Accelerator Physics (SAGENAP) 12-14 March 2002 Meeting Report

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Members at March 2002 Meeting

- Janet Conrad (Columbia)
- Priscilla Cushman (Minnesota)
- Jordan Goodman (Maryland)
- Giorgio Gratta (Stanford)
- Francis Halzen (UW-Madison)
- James Musser (Indiana)
- Rene Ong (UCLA)
- Steven Ritz (Goddard)
- Hamish Robertson (U. Washington)
- Robert Svoboda (LSU)
- James Yeck (DOE)
- Jim Stone (DOE)
- Gene Loh (NSF)

(Conrad was absent; Goodman and Robertson had to leave early)

SAGENAP Charge

- SAGENAP assesses the scientific merit of proposals.
- SAGENAP has not been charged to
  - come to consensus
    - Not a standing panel or committee. More like a collection of individual mail-in reviewers who sit together to share perspectives and work through their opinions.
  - explicitly prioritize experiments
    - However, merit assessment does take into account the known activities in the field.
  - conduct detailed and systematic examinations of management, cost, and schedule (not a Lehman review)
    - However, these (and the overall likelihood of success) have an impact on the scientific potential, so obvious concerns or commendations are noted.

SAGENAP Methodology

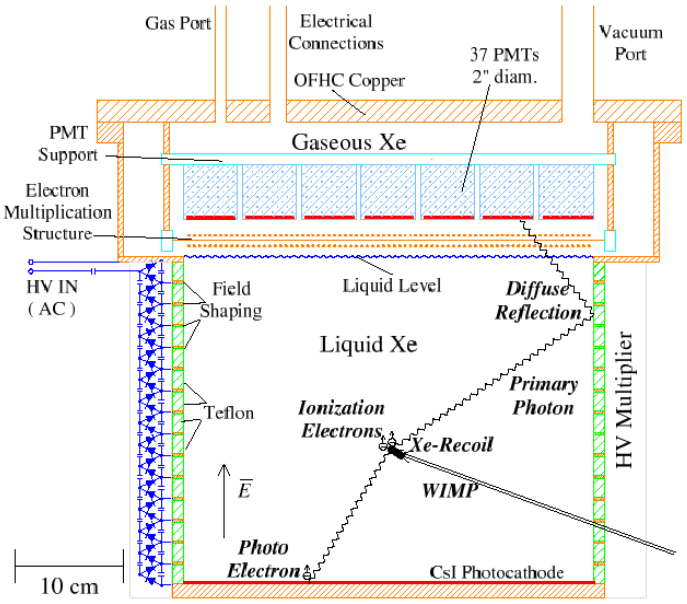
- Proposals are sent to members in advance.
- Proponents make oral presentations at the meeting, followed by questions and answers. Each project is discussed in executive sessions.
- Individual written reviews by members are sent to the agencies and the report coordinator after the meeting. At least 4 individual reviews are written for each proposal. All members are welcome to write reports for all proposals under consideration (except in cases of conflict of interest, which are identified in the first executive session – in these cases, the member leaves the room during all executive session discussions of the project).
- The report coordinator synthesizes written reviews and executive session discussions. The report is circulated to all members for comment. After iterations with members, the report is sent to the agencies.

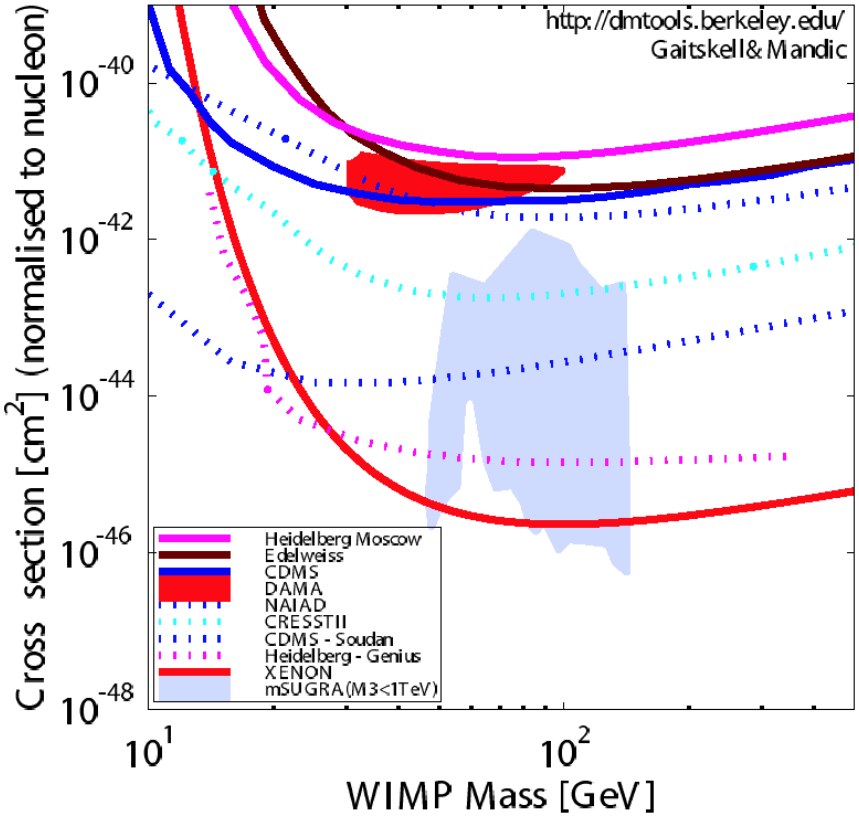
17 Projects Reviewed

- Five proposals:
  - XENON
  - OMNIS
  - 3M
  - Super-Kamiokande repair
  - Solar Neutrino TPC
- Two additional projects:
  - ICARUS (LOI)
  - Nearby Supernova Factor (LBNL project)
- Status reports from 10 ongoing projects:
  - Auger, CDMSII, DRIFT, EXO R&D, HiRes, KamLAND, Milagro, SNAP R&D, STACEE, Whipple/VERITAS

XENON

- R&D toward the design of a 1-ton liquid xenon dark matter detector composed of 100 kg modules. Proposed R&D includes construction and characterization of a 7 kg prototype, and design of the first 100 kg module.





- Potential advantages of LXe
  - scalable to large target mass
  - clear recoil event signature
- PI is Elena Aprile (Columbia); Institutions involved: Columbia, Rice, Princeton, Livermore, and Brown.

XENON: SAGENAP Conclusions

- Members uniformly enthusiastic about the science case for the R&D effort.
- Similar enthusiasm about proposing group.
- Proposed R&D approach is to build 7 kg prototype, and to investigate low-background materials in parallel; SAGENAP members strongly recommended the 7 kg prototype should itself be a low-background detector.
- Schedule is very aggressive, with work complete in two years. Motivation is competition. Concerns about disproportionate funding.
- Concern uniformly expressed about schedule realism, especially given the existing commitments of the team. This should be reviewed carefully, and priorities clearly set.
- Starting an independent R&D effort on LXe dark matter detectors at this time is justified; however, groups should be strongly encouraged to merge at conclusion of R&D phase to propose a single experiment.

Observatory for Multi-flavor Neutrinos from Supernovae (OMNIS)

- Study ν_μ, ν_τ (and high-energy ν_e) from type II SNe.
- Measurement principle: detect neutrons.
- Key design feature: SN rate is low, so must construct low-maintenance detector capable of operating for *decades*.
- Ultimate goal is deployment at WIPP facility. Proponents estimate ~$8M hardware cost of 2kTon detector.
- Complementary to Super-K. OMNIS would detect thousands of ν_μ, ν_τ from an average SN; Super-K detects mainly anti-ν_e.
- Present proposal is for R&D toward detector optimization.
- PI is Kevin Lee (UCLA). Co-spokesperson for R&D is William Burgett (UTD). Spokespersons for OMIS Collaboration are Richard Boyd (OSU) and David Cline (UCLA).

OMNIS: SAGENAP Conclusions

- Members convinced the single-purpose nature of this experiment is OK. Time evolution of neutrino emissions important for understanding explosion mechanism. General idea is worth pursuing.
- Several technical and programmatic concerns expressed about this proposal, including:
  - neutron yields uncertain. Must nail these down.
  - detector aging must be addressed more carefully.
  - relationship between this proposal and other OMNIS efforts unclear. A single OMNIS collaboration R&D program must be formulated.
  - what is the long-term scientific viability of the WIPP site?

Megaton Modular Multi-purpose (3M) Neutrino Detector

- Proposal by Al Mann and Ken Lande (Penn) for design of a flagship, large detector at a National Underground Science Laboratory.
- Array of 10 water-Cerenkov counters, each 100 kton. Current cost estimate: $45M/module.
- SAGENAP conclusions:
  - Physics that can be done at an underground lab (neutrino oscillations, proton decay, neutrino astrophysics) well worth pursuing.
  - Proposed research is extremely ambitious.
  - Recommend this group cooperates with other groups with common interests. Once this cooperation has been formally established, the physics case has been worked out in more detail, and the detector concept optimized for the physics priorities, the proposing groups should return for a review.

Super-Kamiokande Repair

- Requests $2.1M to repair the outer detector, following 12 November 2001 accident.
- Accident was triggered by the implosion of one of the 20" PMTs at the bottom of the tank. Shock destroyed 6,777 of the 11,146 20" PMTs in the central detector and 1,160 of the 1,885 8" PMTs in the outer detector.
- Mechanism for the failure is very well-understood, as is the mitigation to prevent a recurrence.
- Funding on a short schedule is critical to carry out the K2K long-baseline neutrino oscillation experiment: KEK beam is being phased out starting after 2003 to build JHF. Delays in repair result directly in lost, unrecoverable beam time.
- Repaired central detector will initially have 50% of the original photocathode density.

SuperK Repair: SAGENAP Conclusions

- Resounding agreement physics output from SuperK has been superb.
- Equally strong support for continued operation of SuperK in its repaired configuration:
  - K2K running will increase present 2.5σ oscillation significance substantially
  - ν_τ appearance in atmospheric flux could become significant
  - possible observation of oscillations vs L/E
  - significant remaining sensitivity to proton decay
  - still will be the world's premier experiment for SN neutrinos.
- Repair request roughly equal to one year of US-SuperK operating funds. ***"…must be one of the historic bargains in science funding"***

Solar Neutrino TPC

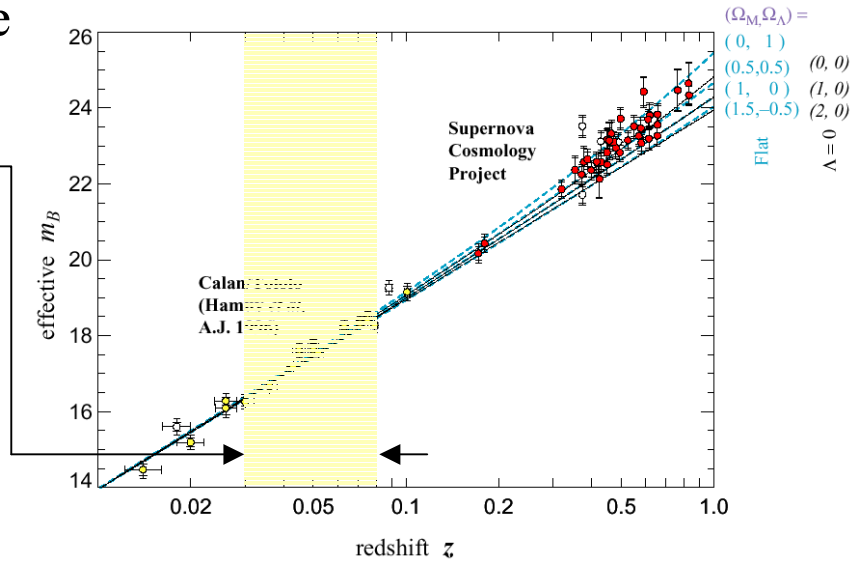
- Proposal for 3-year R&D toward construction of a 10m^3 prototype high-pressure TPC to be located underground. Purpose of R&D is to test technical design choices to enable construction of a very large (~5000 m^3) TPC to study solar neutrinos to very low energy threshold (100 keV) => see full neutrino flux from the sun.
- TPC would enable differential measurement of the energy spectrum.
- PI is Giovanni Bonvicini (Wayne State).

Solar Neutrino TPC: SAGENAP Conclusions

- Generally worth pursuing. Strongest physics case now is solar physics.
- Recommend building a smaller prototype chamber.
- Collaboration should be expanded to include those with experience with high-pressure TPCs and low-background materials. An initially more modest hardware R&D effort, focused on limited essential questions, will give the group time to grow.
- Reconstruction software development should proceed with high priority so simulation results can feed into detector optimization if R&D goes forward.

Nearby Supernova Factory

- Physicists and astronomers from France and LBNL, hosted by LBNL.
- Anchor the low-redshift end (0.03<z<0.08) with good statistics (~100 SNe per year over 3.5 years). Doable from the ground using Haleakala and Palomar I and II.
- Calibrate width-brightness relation at low redshift.



SAGENAP Findings/Conclusions:

- Members convinced project will not distract too much attention away from SNAP R&D; in fact, efforts are synergistic:
  - ➢ excellent opportunity for students
  - ➢ aid in SNAP technology development: use Berkeley CCDs and IFU spectrograph in a data-taking environment over several years.
- Team is reaching out to leading supernova theorists to collaborate on the project.
- With the important caveat that there was no optical astronomy expertise on SAGENAP, members were quite positive about endorsing this project.

ICARUS Letter of Intent

- Not a proposal, an LOI from UCLA group (Cline).
- ICARUS is a large, LAr self-triggering TPC. First module successfully tested in a surface lab in Italy. Moving to Gran Sasso. Multi-module expansion next proposed step.
- Potential continuation of feedthroughs and HV system. Expected level of request: $500k.

SAGENAP Conclusions

- Original physics motivation (p decay) reduced over time. Remaining physics potential for p decay should be worked out in detail in the context of the capabilities of other experiments.
- New, interesting opportunity will arise if CERN to Gran Sasso neutrino beam is constructed. Reality of the CNGS beam uncertain, but this should be sorted out over the next year.
- Very positive about previous contributions of UCLA group to ICARUS, and the continued involvement should the project go forward.

Ongoing Project Status Reports (I)

- Auger
  - engineering array of 40 surface detectors & 2 fluorescence detectors completed, first data. Pre-production run of 100 surface detectors deployed this year. Full 1600-station array to be complete in 2005. Expect significant scientific results from partial array in 2003.
- CDMS II
  - Production of detectors proceeding well. Soudan facility readiness a significant issue (primarily cryo-system); ~8 months behind baseline schedule. Mitigations put into place.
- DRIFT
  - First phase approved in late 1999. DRIFT 1 constructed, active mass 0.17 kg. Engineering runs underway. Design studies for DRIFT2/3.
- EXO R&D
  - Test systems built and being evaluated. Tagging efficiency, purification, energy resolution, low-background materials studies. Prototype in 2003.
- HiRes
  - Data in stereo and mono modes accumulated, new results reported. Significant site access issues since 9/11.

Ongoing Project Status Reports (II)

- KamLAND
  - Now being calibrated and taking first physics data efficiently. First data analysis in progress.
- Milagro
  - Running smoothly. Event reconstruction software in place, demonstrated with first results. "Outriggers" will improve sensitivity. Burst alert system to be implemented..
- SNAP R&D
  - Great progress on all technical fronts (telescope, focal plane instrumentation optimization, s/c requirements, orbit, etc.). No technical showstoppers. Agency cooperation required for mission.
- STACEE
  - Operating well. Already producing results (Crab, Mrk 421). Starting three-year observing program.
- Whipple/VERITAS
  - New results from Whipple. VERITAS funding issues: pursuing 4-telescope array with NSF/DOE to be complete by 2006.

Personal Observations

- It is FUN to see the enormous creativity applied by our colleagues to problems in a rich and widely diverse set of sub-fields.
- The size and diversity of non-accelerator experiments is growing.
  - As these projects grow in scope, their character changes.
  - Prioritization is becoming more important. SAGENAP *could* do this, if properly charged.
  - SAGENAP *could* assess how well overall program is addressing the priorities of the field. The priorities must be set in an open and fully-inclusive manner, and be clearly stated.
  - As the techniques broaden, so must the expertise mix of the reviewing group's membership.
  - Inter-agency coordination and cooperation is essential.