

# Report on the Center for Experimental Nuclear Physics and Astrophysics

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This report responds to a January 29, 2007 letter from Physics Department Chairman David Boulware asking our committee to “review the Center for Experimental Nuclear and Particle Astrophysics management structure and performance”.<sup>1</sup>

As preparation for this report our committee met individually with CENPA faculty, and with groups of CENPA graduate students, postdocs, and staff. Additionally we solicited email comments. We also include here several Appendices of relevant factual information collected from CENPA during the course of our review that inform our findings and recommendations. We note that our review was not informed by a formal self-study or other summary profile documentation from CENPA.

## *Summary of Principal Findings and Recommendations*

The following are the committee’s principal findings and associated recommendations. Our specific recommendations for immediate action appear in **bold type**:

- CENPA has been designated by its primary sponsor, the Office of Nuclear Physics of the Department of Energy, as a Center of Excellence. This is more than a name: CENPA is currently the primary engine behind the Physics Department’s successes in experimental physics. This Center houses many of the Department’s most prominent experiments and produces the bulk of high-impact experimental papers associated with the Department. Its members have won significant awards and gained national acclaim. Several of its recent experiments, such as SNO, torsion balance probes of gravity at sub-millimeter scales, and measurement of the gravitational constant have been included in various “top ten” science results of the year.
- CENPA has been an important source of new directions for the department. It has spawned creative efforts in neutrino physics and astrophysics, laboratory tests of gravity, space physics (including gravitational waves with LISA and lunar ranging), and biophysics. It has become the home of Leslie Rosenberg’s new astrophysics initiative and will house the world’s most advanced axion dark matter detector. It will host the INT/CENPA/Astronomy computer cluster, which will be the most capable computer on campus and a signature example of cost effective, creative and interdisciplinary “e-science”.
- The key to CENPA’s success is its extraordinary infrastructure – technicians, machine shop, support staff, and physical plant. It is the generous DOE nuclear

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<sup>1</sup> The charge letter, including questions 1, 2 and 4 quoted below, give an incorrect translation of CENPA – it is the Center for Experimental Nuclear Physics and Astrophysics.

physics contract, \$5.0M in current-year funding (\$6.3M current-year funding from all sources), and the DOE's classification of CENPA as a Center of Excellence that makes this exceptional level of infrastructure possible.

- **It is imperative that the Department and College remain attentive to the needs of the nuclear physics effort at CENPA, and work to maintain good relations with the Director of the Office of Nuclear Physics.** Loss of this exceptional support will weaken all efforts housed in CENPA.
- The nuclear physics core of CENPA is under great stress. Adelberger and Snover are retiring this year, Storm next year, and possibly Cramer in the next few years. The heavy ion effort will likely end with Cramer's retirement: that is, without a replacement plan coordinated with the agency, current DOE support for a Research Professor and one other senior researcher might also be lost. Some time in the next decade Robertson will likely retire. (Adelberger and Robertson are both members of the National Academy of Sciences.) Current policy in the Office of Nuclear Physics prevents the replacement of Research Professors Snover and Storm. The Department has helped counter these losses by adding Jens Gundlach and Nikolai Tolich. However we recommend that
  - **the department move quickly to make another faculty appointment at CENPA**, while Adelberger remains scientifically engaged and while Robertson remains an active faculty member. CENPA currently provides the Department with its best opportunity to recruit outstanding experimentalists, due to the prominence of its experimental achievements, the eminence of its faculty, and excellent infrastructure for creative experiments.
  - **CENPA create a new research position, CENPA Junior Fellows/Research Assistant Professors, analogous to INT Junior Fellows.** These would be DOE-funded, temporary, showcase positions with terms of ~five years, that would provide promising young researchers an opportunity to make major contributions to CENPA's experimental program. As at the INT, these positions would provide young researchers some measure of security while they seek a suitable long-term faculty opening elsewhere. These positions would replace CENPA's Research Professors. With terms ranging up to five or six years, CENPA Junior Fellows could make major contributions to large-scale efforts like KATRIN and Majorana. We believe that such positions would attract the best creative young experimentalists.
  - **CENPA faculty immediately undertake serious discussion of major new directions for the Laboratory**, including those that would help justify continued DOE infrastructure investments and compensate for the possible loss of heavy ion physics. We recommend that the CENPA Scientific Director lead a streamlined strategic planning exercise, possibly in the form of a retreat where the Director facilitates a serious discussion by faculty about CENPA's long-term future, and produce a document to help in future planning and communication. The document should be shared with the Physics department (including a report at a faculty meeting) and with the College.

- CENPA faculty have an outstanding record in producing PhDs – recent graduates have won prestigious named fellowships, APS thesis awards, etc. The quality of mentoring is exceptional. This is another reason that the loss of four key senior faculty, and the future retirement of a fifth, must be addressed very soon: the capacity of CENPA to host a large group of students is important to students now entering graduate school at the UW.
- The retirement of Derek Storm will require a reassessment and rebuilding of CENPA management. **It is important that current UW support of CENPA administration, now provided as salary support for Storm, be maintained**, as it is the most tangible demonstration of UW/DOE cost sharing at CENPA.
- There are two very capable individuals who could serve as Director or as Scientific Director, Hamish Robertson and John Wilkerson.
- Regardless of the model for choice of Director, **we recommend that the Director make a greater effort to communicate with staff, on a more regular basis**, about factors (such as budget shortfalls) that might affect their status, and about laboratory affairs generally. The current level of anxiety and uncertainty is affecting morale and in general is not warranted.

#### *Responses to Questions in our Charge Letter*

The following remarks amplify on the above findings and recommendations in the context of the seven specific questions posed in our original charge.

##### *1. What is the Center for Experimental Nuclear and Particle Astrophysics (5-10)-year vision (science, faculty, staff, students, funding)?*

CENPA has not articulated a clear vision for itself as a whole. This is partly a result of the entrepreneurial and opportunistic style of research, partly due to the constraints on vision imposed by agency funding, and partly negligence. We believe that a more explicit plan of collective action, originating in the faculty and facilitated by the Director, is needed to help CENPA adapt to forthcoming changes and should be undertaken immediately.

We found that the individual faculty of CENPA have many thoughtful ideas about productive future directions but that they have not shared these widely nor have they attempted to bring their thoughts together into a vision they can explain and sell outside the lab. We recommend a short intense retreat where this discussion can occur, and a concrete document can result that will allow CENPA to make a case to the department and the agency for an exciting and coherent future vision. Many existing elements of excellence will be included in this vision but in addition, it will be necessary to have a plan for moving ahead as retiring efforts are replaced. It will be critical to maintain the base/infrastructure funding, in particular the environment which makes it possible to efficiently mount challenging mid range experiments. Cementing CENPA's center-of-excellence status at DOE and maintaining the umbrella grant are key responsibilities of laboratory leadership.

While the local accelerator is still being used for important experiments, its use is expected to decline in the near future. The DOE recognizes its value for research and education. Its possible uses for still-undetermined future research, for graduate and undergraduate education, and for applied projects such as a proposed TPC neutron detector development for radiation detection/homeland security, make it a valuable asset that should be maintained, if possible.

The opinion is widely held among the faculty that a "new thing" is needed, a new versatile multi-user facility with a unique capability that will eventually replace the tandem as the signature instrument of the lab. We heard that a high intensity laser, with both biomedical and nuclear physics applications, sounds promising; other examples mentioned were neutral atom trapping oriented toward RIA, and possibly including collaboration with TRIUMF, and fundamental neutron physics in a collaboration with NIST and/or SNS. The CENPA tandem could be used as a test facility for some experiments and detectors. These are just some examples among many that should be considered by scientists at CENPA as part of a future planning exercise. The other issue to consider as part of this exercise is the future of the relativistic heavy-ion group; the groundwork for the post-Cramer era should be laid now.

*2. How well is Center for Experimental Nuclear and Particle Astrophysics educating and training students, both undergraduate and graduate?*

CENPA provides an exceptional training ground for hands-on experimental physics. Students have excellent opportunities for exploring projects and research roles, for making creative contributions, and for leading and shaping research programs. The openness of interactions between groups, exposure to many activities, and access to versatile expertise and infrastructure are special attributes of work at CENPA. Postdocs also experience an unusually high level of technical support, helping advance their productivity. CENPA offers a valuable and in some ways unique graduate-student experience.

Our committee was not able to evaluate the quality of undergraduate education at CENPA.

*3. In light of the pending personnel changes, what would be an effective management structure?*

The retirement of Derek Storm is the first of several important pending changes. The current model has Robertson serving as Scientific Director and Storm as Executive Director. In this capacity, Storm has shouldered much of the responsibility for day-to-day administration. This model could be continued. But we also see an alternative possibility, a Director supported by a capable professional (not faculty) Administrator, who would take on significant responsibilities for budget management and day-to-day

staff supervision. The specific model adopted should be designed by the Director in consultation with staff and the Physics chair depending on the individuals involved and their skills and interests. In any case it is important that current UW support of CENPA administration, now provided as salary support for Storm, be maintained, as it is the most tangible demonstration of UW/DOE cost sharing at CENPA.

The success of the lab reflects years of wise leadership by the Scientific Director, Hamish Robertson. The retirement of Storm means that a new model will be needed for internal lab management. The committee feels that Robertson can continue as director with reconstituted executive management. That management could take several forms:

- \* A continuation of the current dual Scientific Director/Executive Director model. One possibility would be the appointment of Peter Doe as Executive Director, when Derek Storm retires.
- \* A new model with a single Director assisted by a highly capable nonscientific Administrator, perhaps with a technical background who would shoulder much of the budget and day-to-day staff management responsibility.
- \* A hybrid of these two models, where an Executive Director like Peter Doe would handle scientific operations issues, while a capable Administrator would handle other administrative matters.

In any of these models, the university needs to continue its commitment to partial administrative support for this to work. We do not feel that a change in Director is needed at this time although some more attention needs to be paid to academic personnel matters that have been neglected. We feel that if and when a change is needed, John Wilkerson will be able to step into the role. In any case a changeover might be appropriate sometime in the next few years as part of a revitalization of CENPA's vision.

*4. The name change from Nuclear Physics Laboratory to Center for Experimental Nuclear and Particle Astrophysics anticipated a broadening of the mission of Center for Experimental Nuclear and Particle Astrophysics and a broadening of the funding sources. What is Center for Experimental Nuclear and Particle Astrophysics's plan to manage multiple programs from various funding agencies?*

Again, our Committee did not find evidence of formal strategic planning in regard to broadening the funding base, and believes this is one of several topics that should be addressed in the streamlined planning exercise that we recommend CENPA undertake. That being said, the informal, entrepreneurial, and opportunistic approach to date has been remarkably successful by all metrics of scientific and academic productivity.

We stress again a point that, from the wording of this question, may need repeating. The name-change to CENPA reflects a broadening of science that naturally occurred due to the creative styles of the faculty engaged there -- the neutrino program, torsion balance efforts, etc., predated the name change. The name-change provided a broader "umbrella"

under which existing programs could continue to expand and grow, with primary support continuing from the DOE Office of Nuclear Physics.

The capacity for such creativity exists because of the exceptional infrastructure at CENPA. This infrastructure, to a first approximation, is sustained almost entirely by the core DOE grant. CENPA's success is due to the consistency of the core support over decades. Other funding sources have been helpful in supporting specific experimental activities. But it would be a serious mistake to consider those sources as a potential replacement for the core grant of approximately \$4M/year.

For this reason we emphasize how critical it is to maintain that core grant and the strong relationship with the DOE Office of Nuclear Physics. That core grant is supporting many of the most visible efforts at CENPA -- SNO, Katrin, Majorana planning, etc. Nationally nuclear physics has followed CENPA in elevating topics like nuclear astrophysics and low-energy beyond-the-standard-model tests to prominence in the field. That is, through evolution nuclear physics has broadened to the point that most of CENPA's most famous work now fits comfortably in the core. The correct strategic plan for CENPA is one that keeps that core grant strong, maintains the Center's trend-setting and creative physics style, and exploits the resulting infrastructure and capabilities to argue for supplementary support from others.

This is why we are concerned that CENPA identify another thrust that will help justify CENPA's designation as a DOE Nuclear Physics Center of Excellence, given that the relativistic heavy ion effort may be phasing out. This is also why we are concerned by the retirement of so many senior teaching and research faculty.

*5. How are resources and staff allocated? How will this evolve as the program changes?*

Our committee is not well informed on this question. There is an opportunity now, with a change of management structure, for members of CENPA to design a new system that meets their needs.

*6. How does Center for Experimental Nuclear and Particle Astrophysics compare to other Department of Energy national University Centers of Excellence?*

The committee does not feel adequately informed to answer this question quantitatively. However, our informal impression is that while CENPA's work has achieved worldwide renown, the lab itself has not projected a "brand recognition" as effectively as it might in the broad physics community. This is one of the areas where better planning and marketing could help better secure the lab's future funding. Even issues as simple as better attention to the website, CENPA labels on papers and talks, and announcing CENPA talks more broadly would help with visibility.

7. *Are there any major issues (related to funding, personnel, facilities, university support) expected in the next few years?*

As noted in our committee's charge letter, a major challenge for CENPA is the large impending turnover of senior staff and faculty. Adelberger, Snover, and Storm are retiring; the department needs to help the lab bridge creatively to a new direction that can help preserve and advance excellence, justify infrastructure, and retain funding.

To sustain funding, the lab needs to find a new activity that will satisfy agency priorities. Since DOE will not fund future appointments of senior research faculty, one exciting option to explore is reprogramming the Storm/Snover DOE salary funds into 5- or 6-year postdoctoral "prize fellowships". These would attract top young researchers, just as the similar INT fellowships have. The productive environment of CENPA would offer great opportunities for professional growth and the long term of these appointments would allow young researchers to play significant roles in multi-year, complex projects like Majorana.

#### *Concluding Remarks on CENPA's value*

CENPA activities are internationally recognized and are critical to the academic and research programs of the Physics department. Far more than being a mere satellite of the department or a specialist outpost for nuclear experiments, CENPA houses many of the department's most important experiments, produces many of its most prominent graduates, makes many of its most famous discoveries, and provides some of its best graduate training. CENPA researchers are lead participants in major projects across a wide spectrum of physics: Majorana (double beta decay), KATRIN (direct neutrino mass search), ADMX (axion dark matter detection), and LISA (gravitational wave detection). In recent years CENPA has produced a number of world-class results with high visibility, ranging from laboratory gravity (including probes of extra dimensions and the mass of the Earth), to new fundamental measurements of neutrino properties. We conclude that CENPA is a "University Treasure" that has consistently brought renown to our department and campus, and should be valued for its unique contribution to the future excellence of our institution.

#### **Appendix 1. Selected honors, awards and service of CENPA faculty**

This list is not meant to be comprehensive, but instead to give a sense of the breadth and accomplishments of the CENPA faculty.

Eric Adelberger and Hamish Robertson are both members of the National Academy of Sciences, recipients of the Tom W. Bonner Prize, Sloan Foundation Fellows, past chairs of the American Physical Society Division of Nuclear Physics, and members of the NAS/NRC Committee on Physics of the Universe (2001-2002). Robertson has been Scientific Director of CENPA since 1998. Both Adelberger and Robertson have many other honors, awards and service too numerous to mention here.

Most of the CENPA faculty are Fellows of the American Physical Society and have served on NSAC, the Nuclear Sciences Advisory Committee or its subcommittees, and on various NSF and DOE review committees. Robertson is a past chair, and Wilkerson is a current member of NSAC.

John Cramer and Tom Trainor continue their work on ultrarelativistic heavy ion collisions as members of the STAR collaboration. Cramer has given a number of talks recently on quantum opacity and the HBT puzzle, and Trainor on fluctuations and correlations in URHI collisions.

Peter Doe has presented several invited talks at conferences and workshops recently, on neutrino properties and on the KATRIN experiment.

Alejandro Garcia's APS Fellowship citation reads: "For innovative measurements related to nuclear beta decay, fundamental interactions, neutrino detector calibrations and nuclear astrophysics." He is co-author (with Ernest Henley) of "Subatomic Physics", 3<sup>rd</sup> edition.

Jens Gundlach has served as a LISA (Laser Interferometer Space Antenna) International Science Team member (LIST, NASA) (2005-present), as a review panel member for NSF for Advanced LIGO (2003), for LIGO operation (2004), and as a member of the Advisory committee for LIGO and Advanced LIGO (2006-present).

Blayne Heckel has been a Sloan Foundation Fellow, an NSF Presidential Young Investigator, and has served on the APS Topical Group on Fundamental Constants and Precise Measurements both as a member and as chair.

Kurt Snover has served on various advisory committees for conferences on nuclear astrophysics and on giant resonances, and has lectured at international summer schools in Erice, Italy and (TRIUMF) Vancouver, Ca.

Derek Storm has served on various advisory committees for TRIUMF (ISAC) and on DOE review panels for RIA R&D. He has served as Director or Executive Director of CENPA (NPL) since 1990.

John Wilkerson has served on the Gran Sasso International Scientific Advisory Committee and on various APS committees. He presented the Henry Primakoff Lecture at the April 2007 APS Meeting.

In addition Leslie Rosenberg and Nikolai Tolich have just joined the Department and CENPA.

CENPA affiliated faculty: Jeff Wilkes, Toby Burnett, Norval Fortson, Robert Vandenbosch (ret.)

## **Appendix 2. Selected CENPA publications and SPIRES citations**

### **Sudbury Neutrino Observatory (various):**

“Measurement of the Rate of  $\nu_e + d \rightarrow p + p + e^-$  Interactions Produced by  $^8\text{B}$  Solar Neutrinos at the Sudbury Neutrino Observatory,” Q.R. Ahmed *et al.* (the SNO collaboration), *Phys. Rev. Lett.* **87**, 071301 (2001) (1363 citations).

“Direct Evidence for Neutrino Flavor Transformation from Neutral-Current Interactions in the Sudbury Neutrino Observatory,” Q.R. Ahmad *et al.* (the SNO Collaboration) *Phys. Rev. Lett.* **89**, 011301 (2002) (1389 citations).

“Measurement of the Total Active  $^8\text{B}$  Solar Neutrino Flux at the Sudbury Neutrino Observatory with Enhanced Neutral Current Sensitivity,” SNO Collaboration, S.N. Ahmed *et al.*, *J. Phys. Rev. Lett.* **92**, 181301 (2004) (593 citations).

More about SNO:

SNO was one of Science Magazine's 10 major stories of the year in 2001.

Science Magazine's 2002 first runner-up Breakthrough of the Year was “Neutrino Insights”, with both the SNO and KamLAND experiments highlighted.

### **Other CENPA nuclear physics papers:**

“Positron-neutrino Correlation in the  $0^+ \rightarrow 0^+$  decay of  $^{32}\text{Ar}$ ,” E.G. Adelberger, C. O. Ortiz, A. Garcia, H. E. Swanson, M. Beck, O. Tengblad, M. J. G. Borge, I. Martel, H. Bichsel, and the Isolde Collaboration, *Phys. Rev. Lett.* **83**, 1299 (1999).

“Quantum Opacity, the RHIC HBT Puzzle, and the Chiral Phase Transition,” John G. Cramer, Gerald A. Miller, Jackson M. S. Wu, and Jin-Hee Yoon, *Phys. Rev. Lett.* **94**, 102302 (2005).

“ $^7\text{Be}(p,\gamma)^8\text{B}$  Astrophysical S-factor from precision cross section measurements,” A. R. Junghans, E. C. Mohrmann, K. A. Snover, T. D. Steiger, E. G. Adelberger, J. M. Casandjian, H. E. Swanson, L. Buchmann, S. H. Park and A. Zyuzin, *Phys. Rev. Lett.* **88**, 041101-1 (2002) (and A. M. Laird), *Phys. Rev. C* **68**, 065803-1 (2003). (61 + 47 citations).

### **Gravity and Short-Range/Macroscopic Force studies:**

“Measurement of Newton's Constant Using a Torsion Balance with Angular Acceleration Feedback,” Jens H. Gundlach and Stephen M. Merkowitz, *Phys. Rev. Lett.* **85**, 2869 (2000). The present CODATA value for big G is based primarily on this reference.

“Sub-millimeter Tests of the Gravitational Inverse-square Law,” C. D. Hoyle, D. J. Kapner, B. R. Heckel, E. G. Adelberger, J. H. Gundlach, U. Schmidt, and H. E. Swanson, *Phys. Rev. Lett.* **86**, 1418 (2001) (295 citations).

“New CP-violation and preferred-frame tests with polarized electrons,” B. R. Heckel, C. E. Cramer, T. S. Cook, E. G. Adelberger, S. Schlamminger, and U. Schmidt, *Phys. Rev. Lett.* **97**, 021603 (2006).

“Tests of the gravitational inverse-square law at the dark-energy length scale,” D. J. Kapner, T. S. Cook, E. G. Adelberger, J. H. Gundlach, B. R. Heckel, C. D. Hoyle and H. E. Swanson, *Phys. Rev. Lett.* **98**, 021101 (2007).

“Laboratory test of Newton's second law for small accelerations,” J. H. Gundlach, S. Schlamminger, C. D. Spitzer, K. Y. Choi, J. Coy, B. Woodahl, E. Fischbach, *Phys. Rev. Lett.* **98**, 150801 (2007).

### **Biophysics:**

“Determination of RNA Orientation during Translocation through a Biological Nanopore,” Tom Z. Butler, Jens H. Gundlach, and Mark A. Troll, *Biophysical Journal* **90**, 190-199 (2006).

### **Appendix 3. Recent CENPA Graduates**

In addition to the recent CENPA graduates tabulated below, we note that three CENPA faculty, Alejandro Garcia, Jens Gundlach and Derek Storm are CENPA (NPL) PhD's.

<u>Student</u>	<u>Advisor</u>	<u>Ph.D. Year</u>	<u>Area</u>	<u>(Accolades) Present Position</u>
Hoyle	Adelberger	2001	Short Range	(Henderson Prize), Humboldt State University Assistant Prof.
Ahmad	(Wilkerson)	2002	SNO	Broad Institute (MIT/Harvard) - Genetics & Genomics
Heeger	Robertson	2002	SNO	(APS dissertation Award 2003); Wisconsin Asst. Prof. (2006)
Reid	Trainor	2002	URHI	Baylor – biophysics
Smith	Elliott	2002	SNO	JPL/CalTech – Mars probe
Mumm	Wilkerson	2004	emiT	NIST – NRC Fellow
Orrell	Wilkerson	2004	SNO	PNNL - Staff member (2006)
Griffith	Heckel	2005	EDM	NIST
Kapner	Adelberger	2005	Short Range	U. Chicago – Kavli Fellow
Miknaitis	Wilkerson	2005	SNO	(APS dissertation Award 2006); U. Chicago – Kavli Fellow

Bacrania	Storm	2006	Nucl. Astrophysics	LANL Staff member
Choi	Gundlach	2006	Short Range	Korea
Duba	Robertson	2006	SNO	DigiPen faculty
Kazkaz	Wilkerson	2006	Majorana	LLNL postdoc
Stonehill	Wilkerson	2006	SNO	(Luise Meyer Schutzmeister Award 2003); LANL Director's Postdoctoral Fellow

#### Appendix 4. Current CENPA Grants

**As shown in this summary table, current CENPA grants total more than \$6.3 M per year, of which \$5.0 M is from CENPA's core nuclear physics activity.**

Grant: Experimental Nuclear Physics  
Agency: DOE  
Current Year's Budget: \$3,823,354  
PIs/Co-PIs: R. G. Hamish Robertson, Derek Storm

Grant: KATRIN Supplement to Experimental Nuclear Physics  
Agency: DOE  
Current Year's Budget: \$1,188,000  
PIs/Co-PIs: R. G. Hamish Robertson, Derek Storm

Grant: Low Energy Frontier  
Agency: NSF  
Current Year's Budget: \$438,000  
PIs/Co-PIs: Eric Adelberger, Jens Gundlach, Blayne Heckel

Grant: Lunar Laser Ranging  
Agency: NASA  
Current Year's Budget: \$34,438  
PIs/Co-PIs: Eric Adelberger

Grant: A comprehensive Probe of Fundamental Gravity Using Next-  
Generation Lunar Laser Ranging Techniques (UCSD sub)  
Agency: NASA flow through UCSD  
Current Year's Budget: \$130,270  
PIs/Co-PIs: Eric Adelberger, Tom Murphy (UCSD)

Grant: Various Torsion Balance  
Agency: NASA  
Current Year's Budget: \$288,000

PIs/CO-PIs: Jens Gundlach, Blayne Heckel

Grant: Short Distance Gravity

Agency: NSF

Current Year's Budget: \$100,000

PIs/Co-PIs: Jens Gundlach

Grant: Nanopore Sequencing

Agency: NIH

Current Year's Budget: \$316,000

PIs/CO-PIs: Jens Gundlach, Mike Niederweis

Notes:

Some additional funds (DOE High Energy Physics) are possible when Leslie Rosenberg transfers his grant activity from LLNL to the UW.

Adelberger's NSF Low Energy Frontier grant will increase to \$600K/yr for three years beginning August 1, 2007.

Gundlach's NASA "Modeling Fixed Points" renewal grant is for \$211K/yr for one year beginning July 1, 2007.

Gundlach has been asked to apply for an NSF Frontier Center grant (these are typically for \$1-4M/yr).