

**Summary of the Neutrinos,  
Neutrons and Fundamental  
Symmetries Long Range Plan  
Town Meeting  
(Chicago, Jan. 19-21, 2007)**

Alan Poon

# Three town meetings in Chicago

- **Neutrinos, Neutrons and Fundamental Symmetries** ( $\nu$ NFS, this talk)
- **American Competitiveness** (Peggy's talk)
- **Nuclear Astrophysics/Study of Nuclei** (I-Y will give a summary two weeks from now)

# Pre-town Meetings

- Before this weekend's town meetings, there were two pre-town meetings:
  - **Neutrinos**: Nov. 18-19, 2006, Santa Fe
  - **Neutrons, Fundamental Symmetries and Dark Matter**: Dec. 7-8, 2006, Caltech

# Outcomes of the Pre-town Meetings

- White papers from the two pre-town meetings:

- **Neutrinos:**

[http://www-mep.phy.anl.gov/atta/dnp/papers/tpm\\_wp3.pdf](http://www-mep.phy.anl.gov/atta/dnp/papers/tpm_wp3.pdf)

- **Neutrons, Fundamental Symmetries and Dark Matter:**

[http://www-mep.phy.anl.gov/atta/dnp/papers/sym\\_wp\\_3.doc](http://www-mep.phy.anl.gov/atta/dnp/papers/sym_wp_3.doc)

<http://www-mep.phy.anl.gov/atta/dnp/papers/dmv2.doc>

# Outcomes of the Pre-town Meetings

## Neutrino Physics – Setting a Course

Baha Balantekin, John Beacom, Guido Drexlin, Yuri Efremenko,  
Steve Elliott, George Fuller,  
Josh Klein, John Learned, Kevin Lesko, Bill Louis,  
Gail McLaughlin, Alan Poon, Raju Raghavan,  
Michael Ramsey-Musolf, Hamish Robertson,  
Kate Scholberg, Nikolai Tolich, Bruce Vogelaar, John Wilkerson  
and  
the Participants of the Santa Fe Pre-Town Meeting

### **Studies of Fundamental Symmetries and Neutrinos in Nuclear Physics**

*The following is a working draft, based on input collected at a “Pre-Town Meeting” held at Caltech on December 7-8, 2006. Approximately 50 members of the community attended the Caltech meeting and provided input through brief presentations and round table discussions. This draft is a work in progress and not a definitive, comprehensive statement by members of the community. It is being circulated in advance of the Chicago Town Meeting in order to provide a concrete basis for discussion. There are clearly areas of fundamental symmetries physics that have not been adequately addressed in this draft. The writing committee will draw upon additional input from the Chicago meeting in order to address any omissions and needed clarifications.*

### **Dark Matter in Nuclear Physics**

**George Fuller (UCSD), Andrew Hime (LANL), Spencer Klein (LBNL),  
Darin Kinion (LLNL), Michael Ramsey-Musolf (Caltech/UW Madison),  
Robert Stokstad(LBNL)**

# $\nu$ NFS Chicago Town Meeting

- Joint plenary sessions with Nuclear Astrophysics/Study of Nuclei town meeting

<i>Charge and LRP process</i>	R. Tribble
<i>Report from Workshop on Education</i>	P. Norris
<i>Nuclear Physics</i>	R. Casten
<i>Neutrino Physics</i>	S. Freedman
<i>Nuclear Astrophysics</i>	J. Truran
<i>Fundamental Symmetries</i>	M. Ramsey-Musolf
<i>NSAC Report on Theory</i>	B. Mueller
<i>Report NSAC RIB Task Force</i>	J. Symons
<i>Status of DUSEL</i>	J. Kotcher

# $\nu$ NFS Chicago Town Meeting

- Parallel working group sessions to collect new materials since the pre-town meetings
- Plenary sessions with report from working group rapporteurs

$\nu$	NFS
<i>Neutrino properties</i> - S. Elliott	<i>Rare &amp; forbidden processes</i> - P. Huffman
<i>Solar, reactor &amp; accelerator neutrinos</i> - J. Klein	<i>Weak probes of strong interaction</i> - B. Holstein
<i>Supernovae, UHE &amp; neutrino interactions</i> - G. McLaughlin	<i>Precision measurements of SM properties</i> - D. Hertzog
<i>Theory</i> - B. Balantekin	
<i>Dark matter</i> - A. Hime	

# $\nu$ NFS Chicago Town Meeting

- Summary report by H. Robertson on Sunday morning (mostly on neutrinos)
- One-hour+ open microphone session
- Discussion of recommendations and white paper

# $\nu$ NFS Chicago Town Meeting

- Robertson's Summary in neutrinos:
  - DOE NP budget: 2% on neutrinos (~\$7M)
  - DOE HEP budget: 4% (\$32M)

DOE NP support is very small

- Capital for all new proposals in NP: LENS, GNuLAND,  $\nu$ SNS, Cuore, Majorana, SNO +,...etc = \$277M (not including DUSEL)
- White paper draft: April 1
- Group of '60' meeting in May

# $\nu$ NFS Chicago Town Meeting

- Recommendations

- I. Study of neutrinos

- i. DUSEL - “highest priority of this [ $\nu$ NFS] White Paper”
- ii. immediate support of  $0\nu\beta\beta$
- iii. Encourage US nuclear physicists to participate in  $\vartheta_{13}$  and mass hierarchy measurement (*subsequently moved to rec. 5*)

# vNFS Chicago Town Meeting

- Recommendations (cont'd)

## II. Search for EDMs - great discovery potential

- i. strongly recommend nEDM

- ii. recommend rare isotope and storage ring EDM

## III. Electroweak studies at facilities such as JLAB, LANSCE, FNPB, NIST, BNL

- i. muon anomaly, neutron decay parameters, polarized electron scattering symmetries.

# $\nu$ NFS Chicago Town Meeting

- Recommendations (cont'd)

## IV. Supernova

- i. comprehensive theory and experimental programs: standard neutrino supernova model, cross section measurements at accelerator facilities, observation of SN neutrinos (diffuse and core-collapse)

V. Encourage support for US nuclear physicists' participation in synergistic programs such as long baseline neutrino ( $\theta_{13}$ , CP violation) and dark matter experiments.

# $\nu$ NFS Chicago Town Meeting

- Laundry list of “important opportunities”
  - Examples:  $0^+ \rightarrow 0^+$ , muon decays, geoneutrinos,  $\nu$  cross sections...etc
- 4 recommendations, 6 initiatives in final LRP 2002.