Update on the Neutron Charge

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NSAC meeting, March 2 2011

Charge Elements: Background

- **2003 subcommittee recommendations**
  - *launch nEDM*
  - *construct new facility at SNS*
- **Agencies response**
  - *Construct FNPB at the SNS*
  - *R&D for nEDM*
- **NSAC LRP 2007**
  - *Neutron physics part of targeted program of symmetry tests of the New Standard Model, and precision EW physics*

Charge Elements: Guidelines

- **Evaluate current and proposed research program**
  - *physics potential in the context of the larger FS subfield*
  - *scientific capabilities and specific opportunities*
  - *international context*
- **Recommendations of priorities in context**
  - *projected resources; constant level of effort at FY2011 levels*
  - *identify most compelling opportunities*
  - *spell out infrastructure and effort required*
  - *both US and international capabilities as backdrop*
  - *priorities for incremental investments beyond constant level*
  - *assessment of current scientific and technical workforce*

Activities since December

- **Mid-December to late January**
  - *Peter and I pinged senior physicists in community*
  - *We got agency guidance on scope of Charge*
  - *Sent invitations to committee members (100% success rate!)*
- **February**
  - *launched subcommittee teleconferences*
  - *formulated a plan of work centered around three meetings*
  - *First meeting planning nearly complete*
- **March**
  - *Finalize plan for second meeting within 2 weeks*
  - *committee self-orientation leading up to first meeting*

Physics Themes

- **nEDM experiment**
  - *compelling physics case in larger context*
  - *large fraction of funding and effort*
- **Weak Interactions with Neutrons**
  - *semi-leptonic weak interactions*
    - ***lifetime is a fundamental parameter; current results inconsistent***
    - ***correlations comprehensively probe neutron charged weak current: evaluate in larger context based on sensitivity to BSM physics***
  - *hadronic parity violation*
    - ***fundamental description of non-leptonic weak interactions***
    - ***connections to other important puzzles in nuclear physics***
  - *Experimental program*
    - ***Evaluate recent progress: degree of difficulty vs physics payoff***

Subcommittee Membership

Professor Hartmut Abele
Technische Universität Wien (Vienna)
Atominstitut der Österreichischen Universitäten

Professor Alejandro Garcia
Department of Physics
University of Washington

Professor John Hardy
Department of Physics & Astronomy
Texas A&M University

Professor Wick Haxton
Department of Physics
University of California, Berkeley

Professor David Hertzog
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University of Massachusetts, Amherst

Dr. Zheng-Tian Lu
Physics Division
Argonne National Laboratory

Professor Michael Ramsey-Musolf
Department of Physics
University of Wisconsin

Professor Michael Romalis
Department of Physics
Princeton University

nEDM:
Fleshing out the Charge

- **Physics case**
  - *within Fundamental Symmetries in Nuclear Physics*
  - *High Energy Physics and Cosmology*
- **Assessment of Status**
  - *Progress to date*
  - *open technical issues and their projected resolution*
- **International context**
  - *Comparison of sensitivity reach with competing experiments*
  - *attention to projected timescales of phases of all projects*
  - *best judgement on progress of world-wide initiatives*

nEDM: Related Issues

- **nEDM *Project***
  - *Status of management plan, budget and project timeline*
  - *identify potential worries*
- **Impact on other neutron physics**
  - *fully understand capabilities of existing facilities*
  - *optimization of existing and projected program resources to maintain balance and maximize physics output and impact*
- **Overall Competitiveness**
  - *nEDM as well as weak interaction physics competition*
  - *unique US capabilities*

Meetings

- **Overall Philosophy**
  - *first 2 meetings are "fact-finding" with focus on US program*
  - *third meeting: round out broad (incl. international) perspective*
- **First meeting focused on nEDM**
- **Second meeting on neutron weak interaction physics**
- **Third meeting to converge on evaluation and recommendations**
  - *could solicit additional talks/input/advice from outside experts*

Timeline for Meetings

- **First meeting focused on nEDM**
  - *April 1 and 2*
  - *Meeting in the vicinity of O'Hare*
  - *main presentations in consultation with collaboration*
  - *revisit important issues and relationship with competing projects in subsequent meeting*
- **Second meeting focused on the rest of program**
  - *April 15, 16, and perhaps the morning of the 17th*
  - *Meeting in vicinity of O'Hare*
  - *will start interactions with full community this week*
  - *Work on topics, speakers, scope in next 2 weeks*

Subsequent Activities

- **Resolution meeting**
  - *Somewhere between mid-May and early June*
  - *Goals and format will evolve from first two meetings*
  - *Unclear at this stage whether any external talks needed*
  - *homework/preparations for this meeting will begin at first meeting*
- **Completion of Subcommittee work**
  - *Early June:*
    - ***Principal recommendations***
    - ***Executive summary***
  - *Full report to be submitted by early September*

Outlook

- **March activities**
  - *Finalize plan for second meeting within 2 weeks*
  - *committee self-orientation leading up to April 1 meeting*
- **Fundamental neutron physics is an important component of the US Nuclear Physics Program**
  - *Essential piece of the Fundamental Symmetries subfield*
  - *technically challenging measurements*
    - ***excellent training ground for the next generation of scientists***
- **Committee must come to grips with maintaining balance, physics output and provide guidance especially around fiscal constraints**