



Long Range Plan for Nuclear Science in Europe



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NuPECC in Brief

The Nuclear Physics European Collaboration Committee is an Expert Committee of the European Science Foundation

ORGANISATION

- Contacts
- Map
- Committee Members
- Members' Addresses
- NuPECC Roadmaps
- Terms of Reference
- Meetings
- Presentations
- Publications
- Members' Area
- Calendar of Events

ACTIVITIES

- Nuclear Physics News
- Long Range Plan 2010
- NuPNET
- IUPAP WG9
- HadronPhysics2 IA
- ENSAR IA
- Small Scale Facilities
- ECOS
- PANS
- NUPEX
- Some Useful Links

SEARCH

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Joint Institute for Nuclear Research
Dubna-
Recently joined

exchanges
with

- AnPHA
 - NSAC
 - Canada
- + ALAFNA

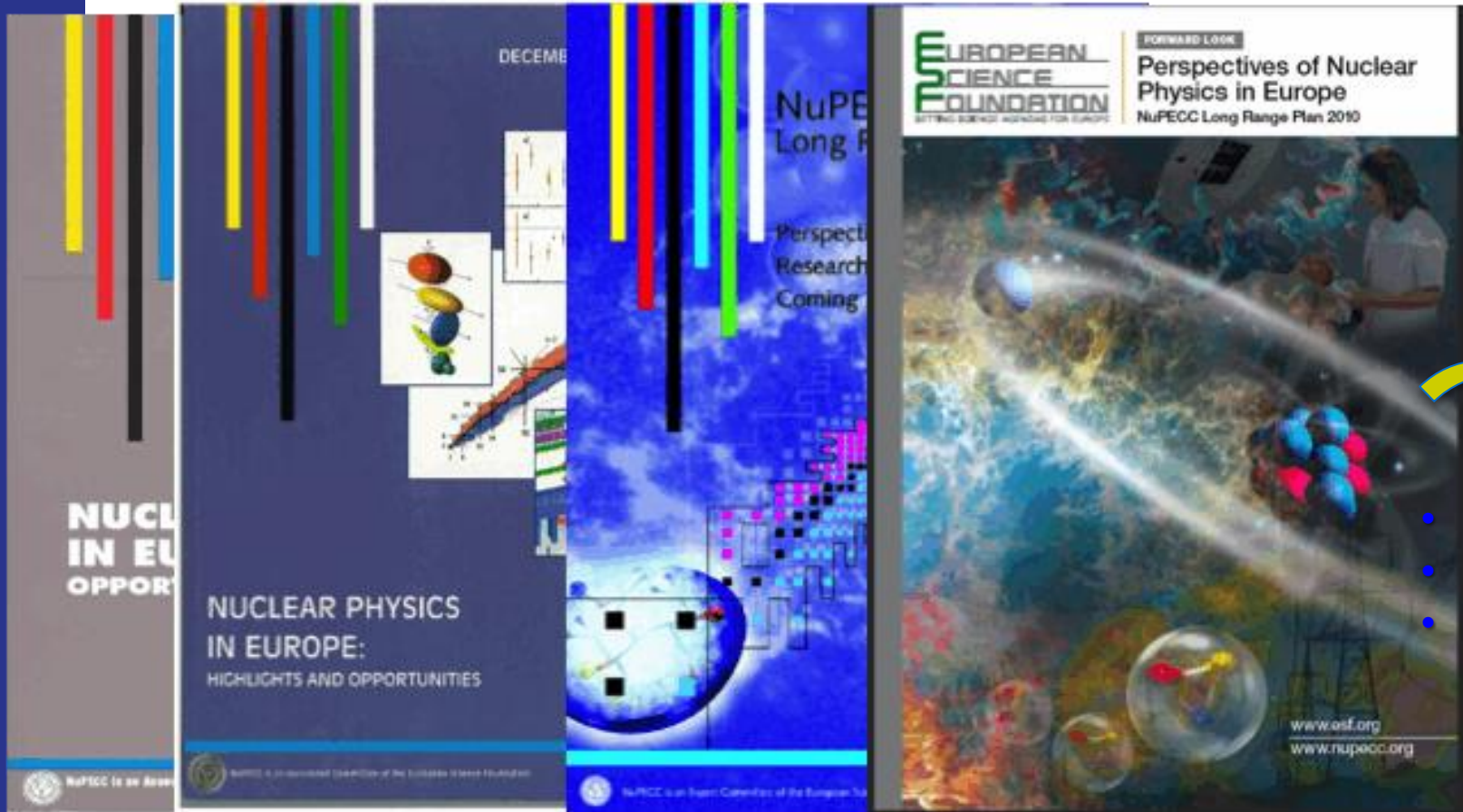
Expert committee of Nuclear Physics

31 Representatives, including ECT*, FAIR, GANIL



Long Range Plan 1991-2010

Perspectives of Nuclear Physics in Europe



1991

1997

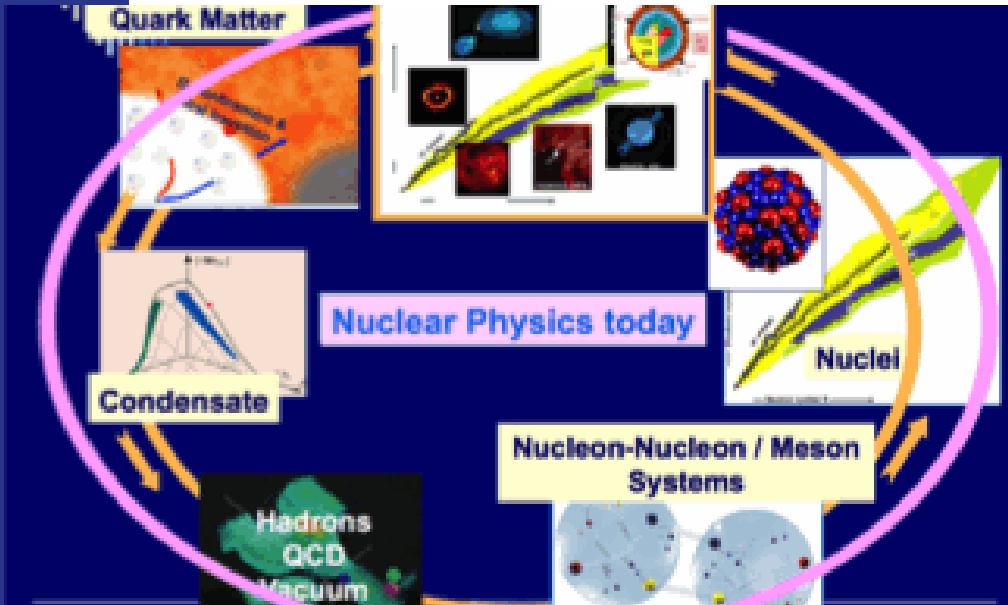
2004

2010

LRP 2017 - Objectives

- **Review** status of the field
- Issue **recommendations** to advance
 - The Nuclear science
 - Its applications in Europe
- Develop **action plan (roadmap)** for:
 - Building** new large-scale Research Infrastructures
 - Upgrading** existing Nuclear Physics facilities
 - Collaborate** closely with smaller scale facilities
- support **EU FP8** projects (ENSAR2)
- Put European Nuclear Physics into **global context**
 - NSAC (DoE & NSF) in USA, ANPhA in Asia, ALAFNA in Latin America
 - IUPAP and OECD Global Science Forum -

Scientific themes



1) Hadron Physics

D Bettoni (Ferrara) + H. Wittig (Mainz)

2) Phases of Strongly Interacting Matter

S Masciocchi (GSI) + F Gélis (CEA Saclay)

3) Nuclear Structure & Dynamics

J Simpson (Daresbury) + E Khan (Orsay)

4) Nuclear Astrophysics

*G Martinez Pinedo (TU Darmstadt) +
A Laird (York)*

5) Fundamental Interactions

K. Kirch (PSI) + K Blaum (MPI Heidelberg)

6) Nuclear Physics Tools & Applications

*M Durante (TIFPA Trento) +
A Letourneau (CEA Saclay).*

One introduction on Facilities + 6 chapters
Summary and recommendations

Nuclear Astrophysics Recommendations

Priorities

1. Nuclear astrophysics, perhaps uniquely, requires access to an extremely wide range of stable and radioactive beams and often involves very long periods of beamtime. It is vital to maintain and enhance the existing network of complementary facilities that have been developed through past coordinated efforts in Europe, from the small university based to the large national laboratory based, to satisfy the increasing demand for these beams and to provide the essential time for instrument development and student training. This is the priority for the period through to 2015 and beyond.
2. Along with the nuclear structure community (WG3) the nuclear astrophysics community is eagerly awaiting the completion of the next generation of radioactive beam facilities (FAIR, SPIRAL 2, HIE_ISOLDE and SPES) which will provide a rich variety of complementary beams needed to tackle more complex issues. This work will become important during the period 2015-2020. The later three facilities are the precursor to EURISOL, which will be developed in the following decade. **EURISOL-DF**

Nuclear Astrophysics Recommendations (II)

3. During the period 2010-2015 it will be essential to select and construct the next generation of underground accelerator facility. Europe was a pioneer in this field, but risks a loss of leadership to new initiatives in the USA. Providing an underground multi-MV accelerator facility is a high priority. There are a number of proposals being developed in Europe and it is vital that construction of one or more facilities starts as soon as possible.
4. The small reaction yields typical of the field mean that high beam currents and extremely sophisticated experimental approaches are required. Towards the end of the decade a high intensity facility as envisaged in the ECOS proposal will be required to enable the nuclear astrophysics community to pursue the more challenging reaction measurements that are at present out of experimental reach.
5. Efforts must be made to strengthen the coordination between the nuclear physicists, astrophysical modellers and astronomers engaged in the field. The recently approved EuroGENESIS EUROCORES programme and the ATHENA network under the ENSAR IA in FP7 must provide leadership in this area.
6. Nuclear theory and astrophysical modeling rely heavily on computing capabilities, both shared memory supercomputing and large cluster distributed memory nodes. The provision of such facilities is essential to progress as is the personnel to develop the theory and codes. Dedicated interdisciplinary positions need to be created at the interface between nuclear physics and astrophysics to ensure that this development can occur.

Conclusions

- **Nuclear Physics is in general a very vital field**
 - The new facilities for nuclear physics on construction will engage the community for several years

 - **Delays in the construction !!!**
 - The community needs to push for the realization of the scientific objectives and to update them when needed

 - **NuPECC is launching a LRP**
 - This will help particularly in the direction of giving the deserved visibility towards the funding agencies and towards other communities in the international landscape
- Town Meeting in January 2017 in GSI

- **Complete ESFRI Facilities**

- FAIR with PANDA, CBM, NuSTAR and APPA
- SPIRAL2 at GANIL including S3 and DESIR

- **Perform Major Upgrades**

- HIE-ISOLDE at CERN
- SPES at INFN-LNL
- AGATA
- SC Linac at GSI

- **Support ALICE at CERN**

- Upgrade the nuclear beams and the detector to expand physics reach

- **Support Theory**

- RI ECT* in Trento
- Projects for advanced studies related to the experimental roadmap
- Dedicated high-performance computing facilities

- **Fully exploit Existing Facilities**

- Lepton beam facilities ELSA in Bonn, MAMI in Mainz, COMPASS at CERN, DAΦNE at INFN-LNF, and hadron beam facilities COSY at FZ Juelich and GSI in Darmstadt

- Heavy ion beam facilities JYFL, KVI, GSI, GANIL, IPNO, ISOLDE, INFN-LNL and INFN-LNS

- Underground labs in Europe such as LUNA at INFN Gran Sasso

- AD at CERN & upgrade ELENA

- Smaller scale national and university labs across Europe dedicated to nuclear structure & astrophysics experiments, fundamental interactions and nuclear applications

LRP2010 Recommendations Cont'd

- **Support Nuclear Physics Applications & Education**

- Secure and develop nuclear physics skills basis for current and future needs
- Develop nuclear energy, medicine & security applications
- Develop of novel sources, beams, targets & instrumentation

- **Promote Planning for Future Large-Scale Facilities**

- EURISOL as RI in future updates of ESFRI list
- Technical Design Study for intense radioactive beams at ISOL@MYRRHA
- Technical Design Studies for PAX and ENC at FAIR
- Technical Design Study for LHeC at CERN
- Inclusion of nuclear physics programmes @ ELI and ESS

