

Information from APPEC on the European Particle Physics Update Strategy process and the GW program in Europe

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APPEC GA Chair

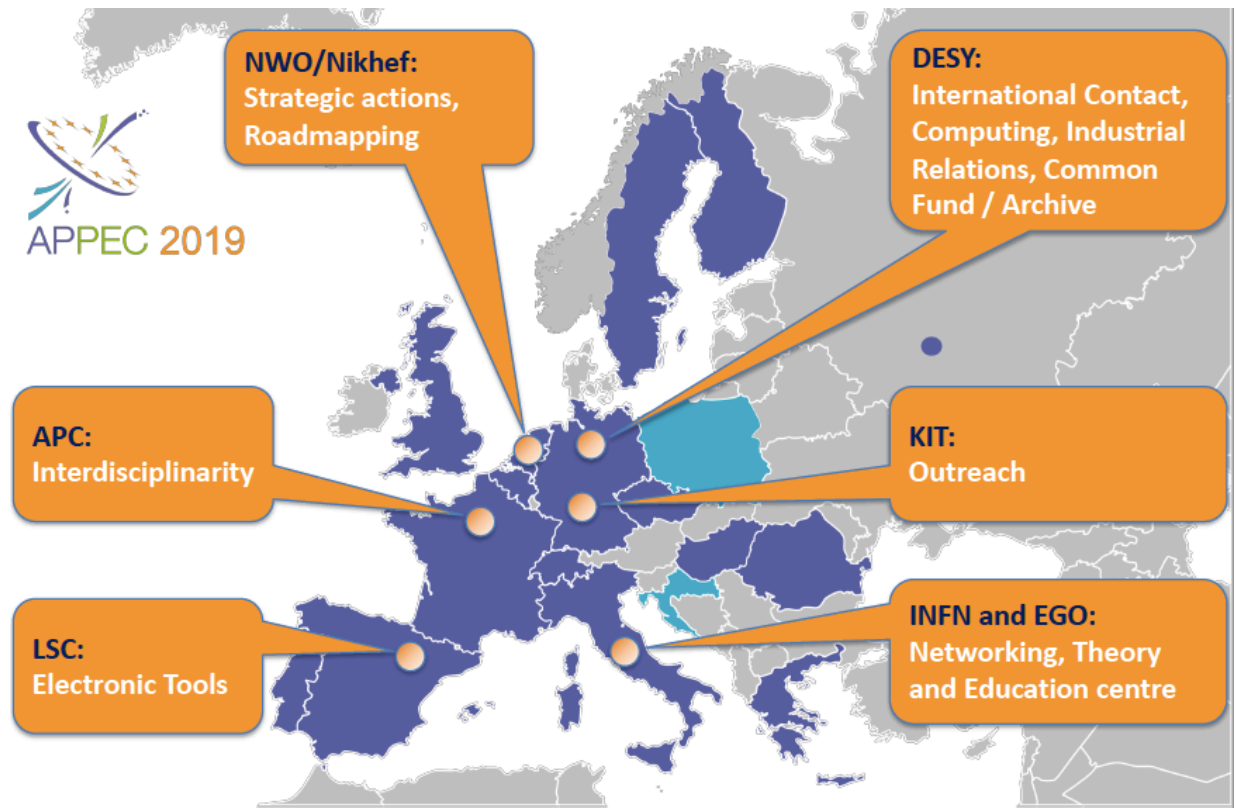
<http://www.appec.org>

Warning: I will focus on the European program and the Einstein Telescope

The APPEC Consortium

- APPEC Consortium defined in the EU funded ERANET ASPERA (2006-2012): informal MoU of funding agencies/ organisations.
- APPEC current scheme:
 - **The General Assembly** : strategic, decision making and supervisory body
 - Chair: TM (UniGeneva), Deputy Chair C. Stegmann (DESY), General Secretary: Job De Kleuver (NWO)
 - **The Scientific Advisory Committee**
Chair: L. Baudis (UniZurich)
vice-Chair: J. Monroe (UniLondon)
 - **The Joint Secretariat** running the functional centres.

<https://www.appec.org>



Update to the EU Strategy process

- CERN Council approved the composition of the:
 - European Strategy Group (ESG): establishes a proposal for the periodic update of the medium-and long-term EU Strategy for Particle Physics which it submits to the **CERN Council for approval**. The APPEC and NuPPEC Chairs are invited.
 - Physics Preparatory Group: drafts its update proposal taking into account the **160** scientific submitted inputs and community input (Granada open symposium). Closer members to the ApP community: **Stan Bentvelsen & Marco Zito Neutrinos and Cosmic Messengers; Dark Sector M. Carena and S. Asai**
 - The Strategy Secretary, Halina Abramowicz, Chairs both committees.
 - There are 5 WGs in the ESG: **WG 1** - social and career, **WG2** - Organizational aspects in the implementation of the European Strategy, **WG3 - relations with external bodies and other fields of physics**, **WG4** - Knowledge and technology transfer, **WG5** - Outreach, education and communication, **WG6** - Sustainability and environmental impact.
- All information on the current process in: <http://europeanstrategyupdate.web.cern.ch>
- **Input documents** in <https://indico.cern.ch/event/765096/contributions/>
- Open Symposium, Granada, May 13-16. Agenda: <https://indico.cern.ch/event/808335/timetable/#all.detailed>

Huge presence of APP Science in Granada!

Mon afternoon

DM
H. Murayama Ultra-light and Ultra-Heavy DM
J. Monroes DD DM
C. Weniger ID DM

Tue

Neutrinos & GW
S. Pascoli Nu Mass and leptonic CP violation
E. Lisi Neutrino mass
M. Mezzetto Prospects
F. Sanchez Neutrino Cross sections
S. Mertens measurements of neutrino mass
B. Fleming Sterile neutrinos
N. Serra Heavy neutral leptons
S. Bangalore Gravitational Waves

Wed morning

Messengers
A. Haungs Cosmic Ray Physics
F. Halzen Neutrino Astroparticle Physics
M. Kowalski Multimessenger Physics

Wed afternoon

Perspective on the European Strategy from the Americas (20'+10')	Young-Kee Kim
Granada Conference Center	14:45 - 15:15
Perspective on the European Strategy from Asia (20'+10')	Geoffrey Taylor
Granada Conference Center	15:15 - 15:45
ApPEC Roadmap (20'+5')	Teresa Montaruli
Granada Conference Center	15:45 - 16:10
NuPPEC long term plan (20'+5')	Marek Lewitowicz
Granada Conference Center	16:10 - 16:35

- Meetings of the ESG: in **Jun. 21, Sep. 24, Dec. 10** (during CERN Council weeks).
- ESG meetings of **WG3** during Council week or dates TBD. This is the relevant WG for discussions on ET.
- Physics **Briefing Book** available on Aug 26 for comments of the ESG; provided to Council on Sep 9 for comments; final version to be submitted on 27 Sep.
- **Dec 2-3** APPEC General Assembly. GW 'recommendation' should be approved.
- Strategy Update write up (Bad Honnef 20-24 Jan). The recommendation should be better ready by Dec 10.
- May 2020 **Strategy Update Document** approved by Council

Big message from the Open Symposium

SM + gravity \neq cosmos (Pilar Hernandez)

Big questions yet need an answer

matter-antimatter asymmetry,
dark matter
dark energy
inflation

The big questions cannot be addressed only by accelerators.
CERN science \neq accelerators science but big question science

Sijbrand de Jong's question: when will CERN worry about unifying gravity with other fundamental forces?

Ferroni et al: ET is an accelerator without a beam

Synergies particle/astroparticle/cosmology via GWs

- **Dark Matter:** BHs contribution to DM ? What they tell us about DM ?
- Gravity tests
- **Multimessenger astronomy:** new lab for matter in most extreme conditions (NS, SN...)
- **Cosmology:** How far back will GW measurements bring us ? Inflation, phase transitions ?

P. Hernandez

Einstein Telescope

...and the match to the expertise of a leading particle physics lab like CERN

M. Kowalski

Vacuum: Vacuum systems for planned 3G detectors will be the largest UHV systems ever conceived (total volume $\sim 10^3 \text{m}^3$) and will account for a substantial fraction of the cost

Cryogenics: The cryogenic cooler must deliver an extremely low noise, steady cooling power of $\sim 100 \text{mW}$ at 10K to the mirror, and must be flexible to support operation

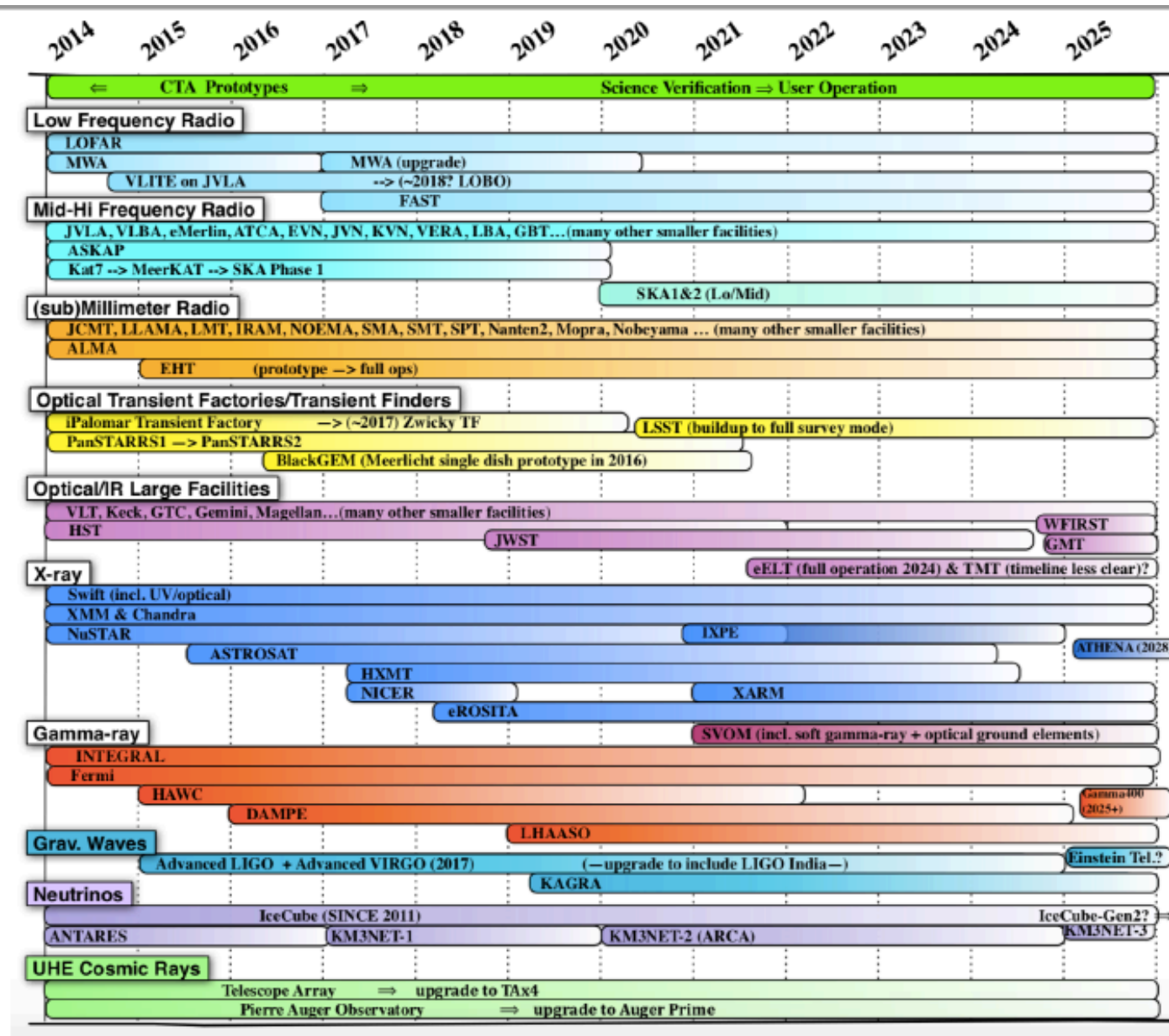
Controls and automation: Control systems for gravitational wave detectors and particle accelerators share the need to control multiparameter systems with a high degree of complexity

Electronics, DAQ: Gravitational wave interferometers are complex opto-mechanical systems, which need to be complemented with vast amounts of electronics

Underground facilities: Minimizing the site facility and infrastructure influence on performance

Governance: Ranging from management technology transfer to realization and management of ET

M. Kowalski: the long schedules are due to lack of European framework for APP large infrastructures?



CTA science book
arxiv:1709.07997

i) the **dark matter searches**;

- ♦ A **Joint Science WG**: *Increase presence of DD/ID scientists in Physics Beyond Colliders / LHC DM WG / a new WG? for cooperation on data analysis methods and comparison of data strategies*
- ♦ DM searches require a strong **theoretical support**.

ii) the **multi-messenger astronomy**, in particular the **3G GW** experiments (ET);

- ♦ synergy with the multi-messenger astrophysics has the potential with the future generation of gravitational wave detector, the Einstein Telescope, to incorporate gravity within the model of fundamental interactions, to pin down the nature of dark matter and to explore matter in extreme conditions.
- ♦ Cooperation on structuring the governance, long term operation of underground infrastructures and on technology being defined by the Collaboration.
- ♦ APPEC support through a committee of experts on large organisations and infrastructures

iii) the **neutrino physics**;

- ♦ Full support to exploitation of **CERN Platform program** and participation to discussion on interplay of results from atmospheric neutrinos (hierarchy, nutau appearance, matrix elements & mass-squared differences precision, cross sections at HE, sterile neutrinos,...), and astrophysical neutrinos (exotic interactions, nutau appearance)
- ♦ Clarification on nature of neutrinos is a major quest. Roadmap for **neutrinoless-double beta decay**. Workshop in Sep-Oct followed by meeting with US later.

iv) the creation of a **European Center for AstroParticle Theory (EuCAPT)**

ESG-WG3 and interaction with CERN management/Council

- ESG-WG3 discussions: First meeting in Granada. Next on Jun 21.
- Would a RE status and dedicated MoU suffice ET needs? ET in the CERN program option (CERN rules)?

Recognized Experiments @ CERN (REC): approved experiments from particle physics and nearby disciplines (e.g. astroparticle) with substantial participation of CERN Member State physicists. REC benefit from intellectual exchanges with scientists at CERN and, within available CERN resources, from usage of computing, infrastructure for meetings, access to test beams and laboratory equipment. Examples of REC: MEG, Mu3e, Belle-II.

From F. Giannotti's slide

- In the contest of WG3, it was requested to formalize a coherent and clear request from ET as Collaboration on cooperation with CERN. Members of CERN Council in the WG3 are supportive for ET as CERN program.

Future steps

- Briefing Book is responsibility of PPG (Stan Bentelven)
- 14-16 Oct. JENAS meeting, <https://jenas-2019.lal.in2p3.fr> where the slot is reserved on: Current and future physics with GW experiments, G. Losurdo
- As member of ESG, APPEC Chair (in ESG) will be able to provide a strong recommendation agreed with the ET Collaboration to be part of the final strategy document.
- **Science synergy prominent in the recommendation:** The future generation of GW ground-based detectors, which in Europe is the Einstein detector, has the unique potential to explore the dark matter nature, its location in the cosmos, and to understand the fraction of it that is not a particle. With its capacity of testing gravity at extreme curvatures and matter in extreme conditions, such as in black holes or pulsars, it explores new frontiers in cosmology and particle physics and specifically the unification of all forces, including gravity. The potential to explore heavy elements formation, and exotic forms of matter has also the potential to strengthen synergy between the nuclear, particle physics and cosmology communities. Not last, gravitational waves as part of multi-messenger astronomy has a striking potential of cosmic exploration, reaching out the fantasy of any citizen. Such exploration concerns also technology and computing challenges, and open access policies, which need to be developed in cooperation with CERN.
- More in J. de Kleuver talk (documents for ESFRI, schedule, panel on governance,...)