European Strategy on Astroparticle Physics and ApPEC

Maurice Bourquin

ApPEC Chairman

The European Roadmap for Astroparticle Physics, 2011 Edition

> ASPERA and ApPEC have charged the SAC
  - Detailed information, milestones, budget and calendar

> Results and recommendations in various domains
  - For European government agencies

> Brings clarification, transparency

> Welcome by national agencies

> Can be put in perspective with own national plans

>> We hope it can be implemented. Great science!

Role of the agencies: to turn dreams into reality

> Difficult task for managers:

- Requested to support Roadmap projects
- Under pressure from other disciplines and limiting financial measures by finance ministries

> How to find equilibrium between large appeal of ApP and scarcity of resources?

> Decision to invest in new infrastructure affects domain of research for a long time

>> ApPEC should be able to help

> In 2001 a few visionary leaders agreed to sign a MoU for the **formation** of ApPEC.

- 6 agencies and ESF

- Has raised the profile of ApP in Europe

> Currently consists of agencies from 12 countries

- Belgium (FNRS,FWO), France (IN2P3/CNRS, DSM/CEA), Germany (BMBF), Greece (Demokritos), Italy (INFN), Poland , Portugal (FCT), Romania (*IFIN HH*), Spain (MICINN), The Netherlands (FOM), Switzerland (CHIPP), United Kingdom (STFC), CERN (Observer).

- Chairmen J.J Aubert, J. Engelen, R. Petronzio, R. Wade and M. Spiro

ApPEC operates:

> Strategically through its Steering Committee consisting of heads of agencies

> Operationally through its Science Advisory Committee (current chairman C. Spiering)

The main achievements of ApPEC are:

> the launching of pan-European peer reviews of the main fields of Astroparticle Physics (2002-2004)

> the successful submission of EU-I3 Astroparticle Physics network ILIAS (2005-2009)

> the successful submission of the Astroparticle Physics EU-ERANET ASPERA (2006) and its continuation ASPERA-2 (2009) >>

>> The main achievements of ApPEC are:

> the publication in the context of ASPERA of a European Strategy for Astroparticle Physics (2008)

> the coordination with neighboring fields attested by its representation in the European Strategy Session of CERN Council and the common priorities defined with the Astrophysics ERANET ASTRONET and the ESFRI roadmap (2008-2009)

> the initiation of an effort of world-wide coordination in the context of the OECD Global Science Forum study of Astroparticle Physics (2009-2010)

Role of ApPEC in the implementation of the Roadmap ?

> Firstly ApPEC issued a policy statement, together with the ASPERA Governing Board:

"Statement on the Future of the European Astroparticle Physics"

*"**Co-operation** is the only way to achieve the critical mass for projects which require budgets and personnel not available to a single agency."*

*"The Roadmap is also a timely input into the update of the European Strategy for Particle Physics launched by **CERN Council**."*

- Medium scale projects, or upgrades at different stages of realization,
- large scale projects whose construction needs to start towards the middle of the current decade,
- and very large scale infrastructures being developed on a longer time scale.

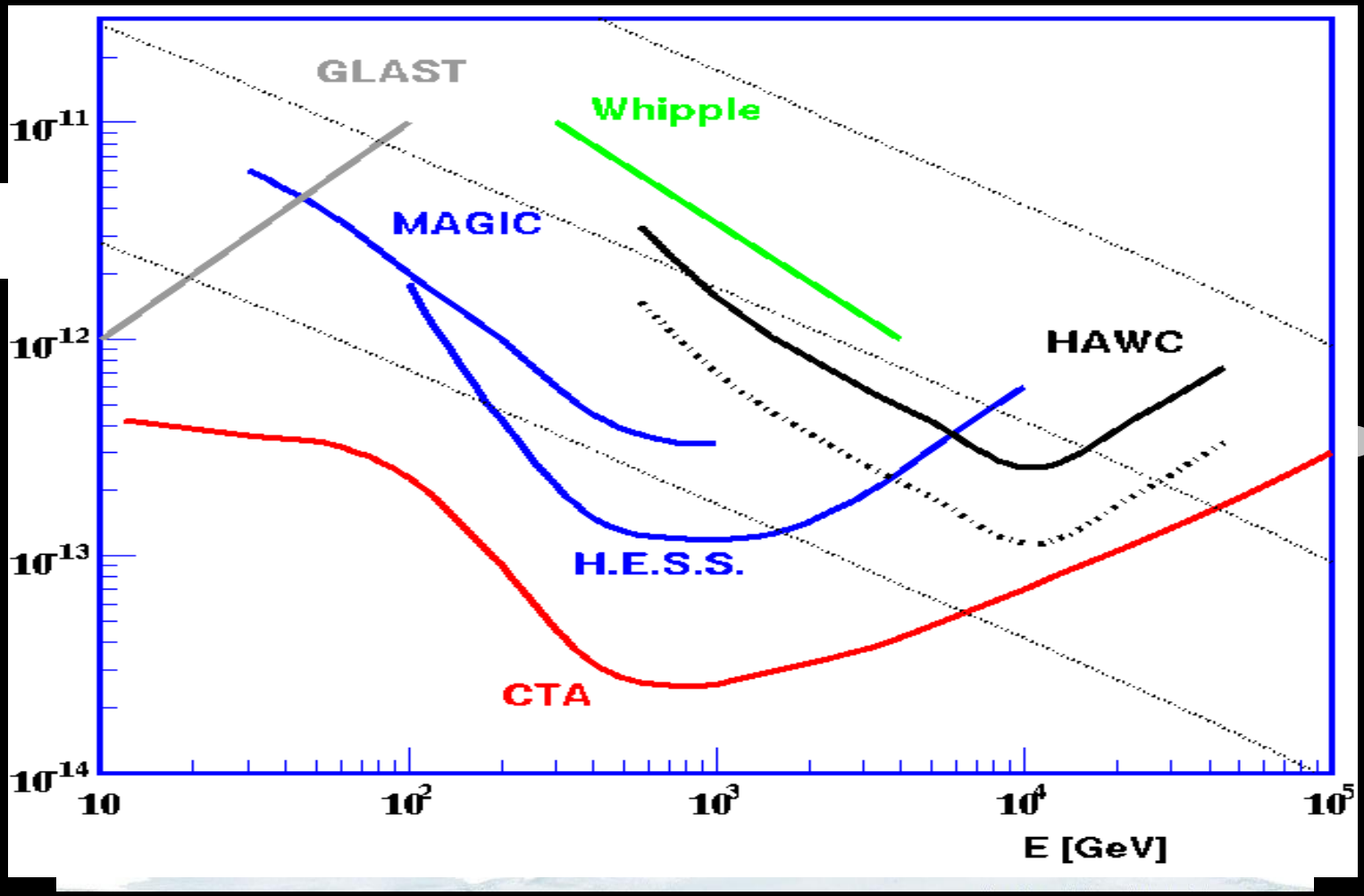
Medium scale program and upgrades

1. **Gravitational wave advanced detectors,**
   - First detection in the next five-seven years ?
2. **Dark matter searches,**
   - WIMP dark matter proven or disproven in the next 10 years together with progress at the LHC ?
3. **Neutrino property measurements,**
   - Access to the largest part of the inverted mass hierarchy spectrum
4. **Underground laboratories**,
   - Unique window of opportunity to extend the Laboratory of Modane.
   - Continuation of support to the Gran Sasso, Canfranc
5. **Space-based detectors**
   - Understand the composition/spectral features of cosmic rays.

Large scale projects

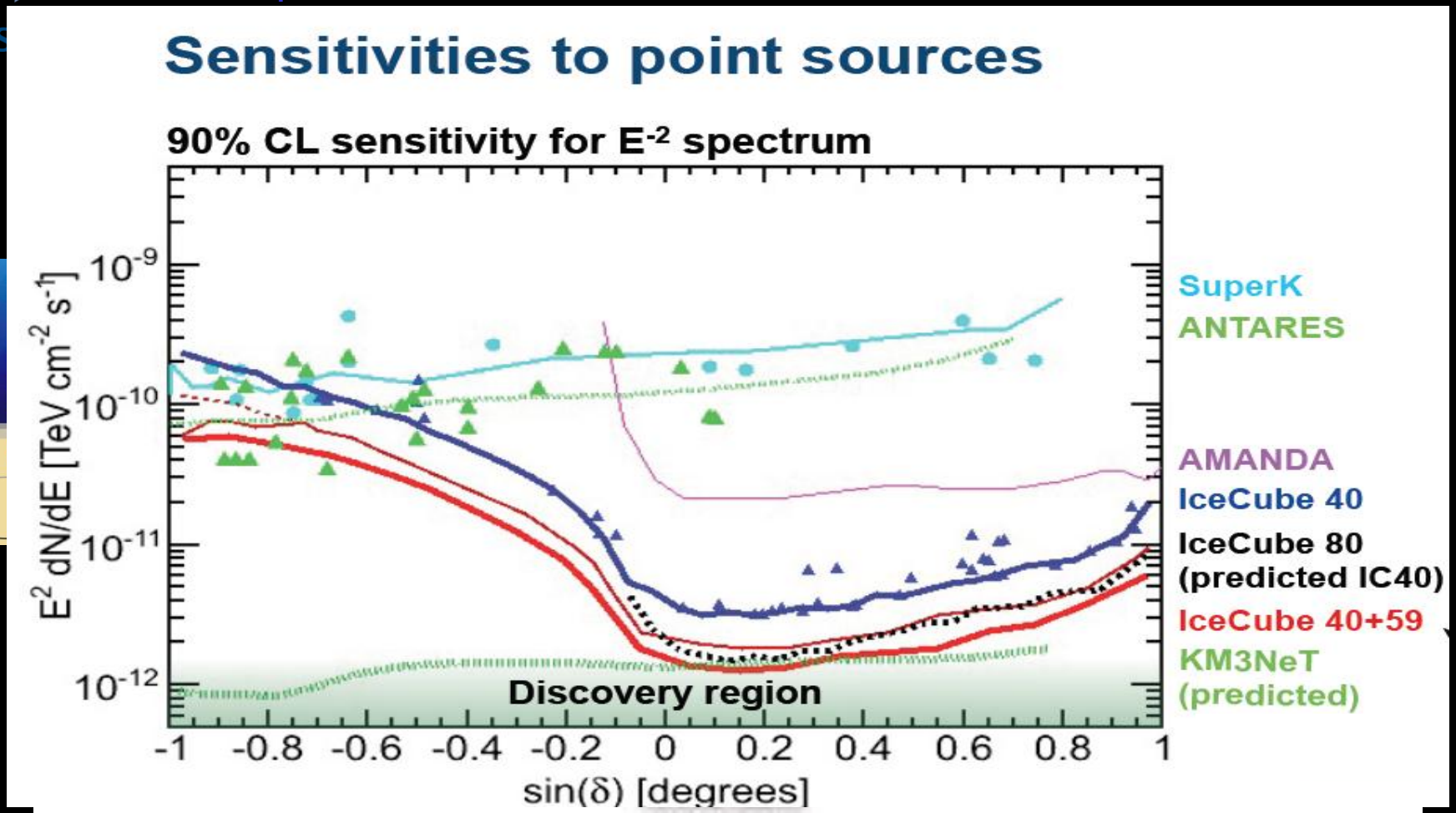
1. **Cherenkov Telescope Array** (**CTA)** is the worldwide priority project, in the domain of TeV gamma-ray astrophysics .
   - Ambitious time schedule for technical design and prototype development , site selection , aiming at a start of construction by the middle of the decade.
2. **High-energy neutrino telescope** in the Mediterranean Sea (**KM3NeT**),
   - Technology definition is in its final stages with prototype deployment within the next 2-3 years, and access to deep-sea research.
3. A global **next-generation ground-based observatory**
   - Need to develop new detection technologies, search for appropriate sites, attract new partners.
4. A megaton-scale detector (**LAGUNA/LAGUNA-LBNO)** for low-energy neutrino astrophysics, proton decay and accelerator driven neutrino physics
   - Global context and interface with CERN European Strategy Update
   - Favourable physics case with recent results by T2K, DCHOOZ, MINOS

High energy gamma ray telescopes



In the domain of TeV gamma-ray astrophysics the **Cherenkov Telescope Array** (**CTA)** is the worldwide priority project. It combines proven technological feasibility with a guaranteed scientific perspective. Its mode of operation and the wealth of data are similar to a large astronomy project. The ambitious time schedule for technical design and prototype development of CTA, as well as the selection of the site(s), is aiming at a start of construction before the middle of the decade.

High Energy Neutrino Telescope *KM3net*



The next generation **high-energy neutrino telescope** in the Mediterranean Sea (**KM3NeT**), an ESFRI project, must have sensitivity substantially larger than that of IceCube, the neutrino telescope operating in Antarctica. The KM3NeT collaboration produced a corresponding technical design report, funded by the EU Preparatory Phase program. The technology definition is in its final stages with prototype deployment within the next 2 years, and eventual access to deep-sea research.

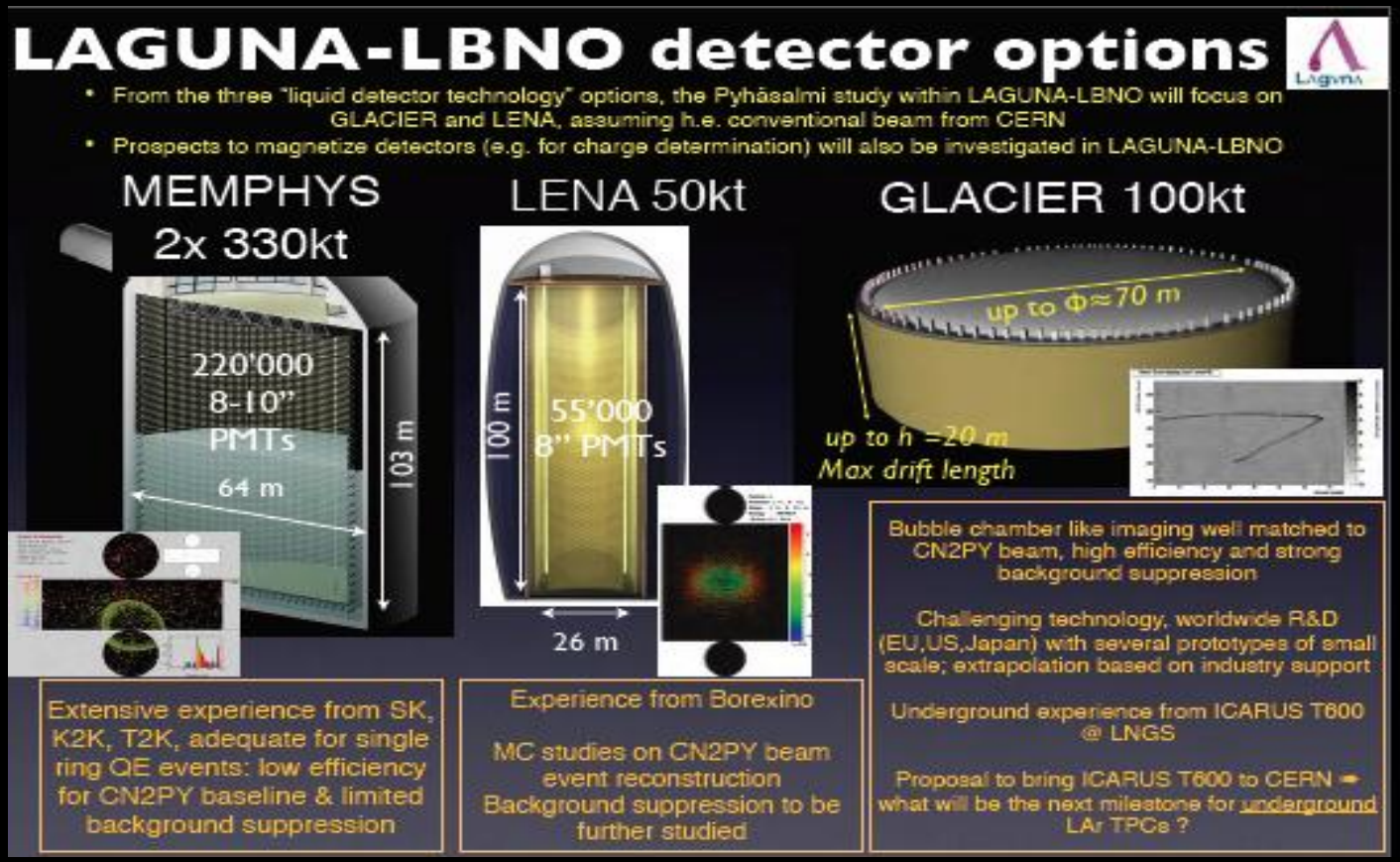
High energy cosmic ray observatories

PAMELA
ATIC
CREAM

AMS
JEM-
EUSO

Following the footsteps of the Pierre Auger Observatory in Argentina a global **next-generation ground-based observatory** is envisaged with a substantial contribution from Europe**.** The preparations include the development of new detection technologies, the search for appropriate sites, and the attraction of new partners.

Megaton scale projects for proton decay and neutrino physics



The goals of a megaton-scale detector as addressed by the design studies **LAGUNA** range from **low-energy neutrino astrophysics** (e.g. supernova, solar, geo- and atmospheric neutrinos) to fundamental searches without accelerators (e.g. search for **proton decay**) and accelerator driven physics (e.g. **observation of CP-violation**). Due to its high cost, the program can be developed only in a global context; furthermore the timing of its realization depends strongly on whether the indications for the mixing parameter defined as θ_{13} were to be confirmed within the next one or two years, permitting a series of very exciting measurements for neutrino mass hierarchy and CP violation using CERN beams. LAGUNA is therefore clearly at the interface with the CERN European Strategy Update to be delivered early 2013, where it represents a high-priority astroparticle project.

Longer time-scale projects at the interface with other disciplines

1. Astroparticle physicists play a major role in many international **Dark Energy programs,** such as the recently chosen Cosmic Vision ESA satellite **EUCLID** or the dominantly US-funded **LSST** observatory.
   - First light and/or launch towards the end of the decade

2. Gravitational wave research beyond the advanced detectors stage foresees two projects of a very large scale: the Earth-bound **Einstein Telescope (ET)** and the space-bound **LISA** project.
   - ET construction would start after the first detection of gravitational waves (end of the decade)
   - LISA launch in the 2020's, relying on the success of the technological mission LISA-Pathfinder (2015)

- **ApPEC welcomes the priorities defined by the scientific communities in the 2011 version of the Astroparticle Physics Roadmap.**

- **ApPEC accepts the recommendations with best endeavours to implement them**

> The Roadmap is available

- A complementary programme to the CERN programme in particle physics

> Information about projects, resources needed, and timescales

> In particular 4 projects to be constructed in the middle of this decade, costing one or more hundreds of Million Euros each

> Require budgets and personnel not available in a single agency

> And longer time scale projects in the domains of dark energy and gravitational waves.

> *How can the agencies provide "best endeavours to implement them"?*

- In the absence of CERN-like or ESO-like structure for ApP
- Without ASPERA ERAnet ending in June 2012

> Logical solution: ApPEC organises the coordination

- But ApPEC has limited potential of action today and
- No real authority to achieve real European cooperation

> Lack of common financial resources

> Lack of common staff

> Lots of Goodwill

> Inject now a dose of politics in the system

> Common programming has to replace random agreements

> Build a common vision for ApP in the various ministries/funding agencies

> Create a desire to follow ApPEC through its ideas and have leaders defend them

> ApPEC can be the solution by being more dynamic

> Use the experience existing for setting up scientific projects of this magnitude

> *Caveat: the activities of ApPEC should not interfere with national or regional mechanisms for funding*

> These are the motivations of the Steering Committee behind the process initiated for **a development** of ApPEC

> beyond its initial **formation** phase, which has achieved its initial goals by means of the ten year old MoU.

> Adopt more progressive **strategic and implementation objectives**:

done, see below

> Identify the partners wishing to support the participation in a coordination body to implement the new objectives, through the signature of **a Letter of Intent** by Ministries or funding agencies: ***in progress, some agencies have signed***

> Create **a new structure** through a new Memorandum of Understanding***:*** ***on its agenda***

> Provide a discussion forum for the coordination of European ApP;

> Develop and update long term strategies (e.g. Roadmap for European ApP);

> Participate in the European scientific strategy with organisations such as the European Strategy Session of CERN Council and ESFRI;

> Develop closer relationships with organisations such as CERN, ESA and ESO;

> Express collective views on ApP in international fora.

ApPEC Implementation objectives

> Facilitate and enhance the coordination between existing or developing national activities;

> **Develop a common action plan for large ApP infrastructures based on the Roadmap;**

> Facilitate the convergence of future large scale projects/facilities;

> Provide organisational advice for the implementation of future large scale projects/facilities, for instance initiate and/or accompany the creation of resource review boards for international collaborative projects where the national funding agencies are involved;

> Initiate and guide European funded activities;

> Launch common actions including common calls.

> Letter of Intent « **Concerning the Participation in Astroparticle Physics European Coordination** »

Signatures: Italy, Switzerland, Romania…

> Memorandum of Understanding

Organisation consisting of 3 bodies:

- the General Assembly and its Steering Committee
- the Scientific Advisory Committee (SAC)
- the (distributed) Office

To be discussed by ApPEC

> Valuable experience has been gained during the setting up and implementation of the ASPERA common calls for R&D projects.

- The ApPEC should be a facilitator
  - Provide organizational advice for the implementation of future large scale projects/facilities, for instance initiate and/or accompany the creation of resource review boards for international collaborative projects where the national funding agencies are involved;

> Many of the projects in the ApP Roadmap have an overlap with particle physics: properties of neutrinos, search for Dark Matter… Those will be included in the CERN Council European Strategy Update, where ApPEC is a partner

> ApPEC is represented in the European Strategy Session of CERN Council and in the European Strategy Group.

> ApPEC and CERN have approved a common workplan.

> The workplan has to be implemented: we have drawn the attention of the CERN Management to several issues:

> A Particle Astrophysics and Cosmology Theory Programme.

> Common Outreach and K&T Transfer activities.

> CERN participation in future projects in the area of APP.

> The participation of CERN to a distributed structure for ApPEC, where CERN, as an observer, could play a important role.

> ApPEC collaboration with ESO and ESA would be very valuable

> It seems that only ESO observer attendance to ApPEC meetings is possible at this time, because ESO is overbooked with own projects (E-ELT)

>> We have to go beyond Europe! To internationalize the process of coordination

> We considered setting up a FALC like body (global participation of major funding agencies)

> Now an opportunity exists with APIF, following the successful WG on ApP, under the umbrella of OECD GSF

> ApPEC and ASPERA welcome the priorities defined by the scientific communities.

> They accept the recommendations addressed to the governmental funding agencies with best endeavours to implement them.

> Co-operation is the only way to achieve the critical mass for the ambitious projects.

> The Roadmap is also a timely input into the update of the European Strategy for Particle Physics launched by CERN Council.

> ApPEC looks forward for a fruitful cooperation with global international partners, thanks to APIF.

> The ApPEC Steering Committee members are very grateful to the SAC members.