The European strategy for particle physics

General issues

1. European particle physics is founded on strong national institutes, universities and laboratories and the CERN Organization; *Europe should maintain and strengthen its central position in particle physics.*

2. Increased globalization, concentration and scale of particle physics make a well coordinated strategy in Europe paramount; *this strategy will be defined and updated by CERN Council as outlined below.*

Scientific activities

3. The LHC will be the energy frontier machine for the foreseeable future, maintaining European leadership in the field; *the highest priority is to fully exploit the physics potential of the LHC, resources for completion of the initial programme have to be secured such that machine and experiments can operate optimally at their design performance.* A subsequent major luminosity upgrade (SLHC), motivated by physics results and operation experience, will be enabled by focussed R&D; *to this end, R&D for machine and detectors has to be vigorously pursued now and centrally organized towards a luminosity upgrade by around 2015.*

4. In order to be in the position to push the energy and luminosity frontier even further it is vital to strengthen the advanced accelerator R&D programme; *a coordinated programme should be intensified, to develop the CLIC technology and high performance magnets for future accelerators, and to play a significant role in the study and development of a high-intensity neutrino facility.*

5. It is fundamental to complement the results of the LHC with measurements at a linear collider. In the energy range of 0.5 to 1 TeV, the ILC, based on superconducting technology, will provide a unique scientific opportunity at the precision frontier; *there should be a strong well-coordinated European activity, including CERN, through the Global Design Effort, for its design and technical preparation towards the construction decision, to be ready for a new assessment by Council around 2010.*

6. Studies of the scientific case for future neutrino facilities and the R&D into associated technologies are required to be in a position to define the optimal neutrino programme based on the information available in around 2012; *Council will play an active role in promoting a coordinated European participation in a global neutrino programme.*

7. A range of very important non-accelerator experiments take place at the overlap between particle and astroparticle physics exploring otherwise inaccessible phenomena; *Council will seek to work with ApPEC to develop a coordinated strategy in these areas of mutual interest.*

ApPEC Road Map

Major European initiatives in the next decade: a scenario

The European astroparticle community has a lead position in many fields. The roadmap and its recommendations illustrate this claim in detail. We assume that the process of cooperation and coordination converges to the following major (cost > 50 M€) activities between 2009 and 2015. The Table gives a summary information on the projects, the following text a short background and explanation.

Field/ Experiments	**Cost scale (M€)**	**Desirable start of construction**	**Remarks**
Dark Matter Search: Low background experiments with 1-ton mass	60-100 M€	2011-2013	2 experiments (different nuclei, different techniques), e.g. 1 bolometric, 1 noble liquid; more than 2 worldwide.
Proton decay and low energy neutrino astronomy: Large infrastructure for p-decay and ν astronomy on the 100kt-1Mton scale	400-800 M€	Civil engineering: 2012-2013	- multi-purpose - 3 different technological options - needs huge new excavation - most of expenditures likely after 2015 - worldwide sharing
Properties of neutrinos: Double beta experiments	60-80 M€	2011-2013	- explore inverse hierarchy scenario - 2 experiments with different nuclei (and desirably more worldwide)

The high energy universe:			
Gamma rays: Cherenkov Telescope Array CTA	100 M€ (South) 50 M€ (North)	first site in 2010	Physics potential well defined by rich physics from present gamma experiments
Charged Cosmic Rays: Auger North	85 M€	2009	Confirmation of physics potential from Auger South results expected in 2007
Neutrinos: KM3NeT	300 M€	2011	FP6 design study. Confirmation of physics potential from IceCube and gamma ray telescopes expected in 2008-2010
Gravitational Waves: Third generation interferometer	250-300 M€	Civil engineering 2012	Conceived as underground laboratory

EPP2010

The results of the committee's analysis have led to its chief recommendation. **The United States should remain globally competitive in elementary particle physics by playing a leading role in the worldwide effort to aggressively study Terascale physics.**

To implement the committee's chief recommendation, the Department of Energy and the National Science Foundation should work together to achieve the following objectives in priority order:

- Fully exploit the opportunities afforded by the construction of the Large Hadron Collider (LHC) at the European Center for Nuclear Research (CERN).
- Plan and initiate a comprehensive program to become the world-leading center for research and development on the science and technology of a linear collider, and do what is necessary to mount a compelling bid to build the proposed International Linear Collider on U.S. soil.
- Expand the program in particle astrophysics and pursue an internationally coordinated, staged program in neutrino physics.

The LHC will begin exploratory research at the Terascale within the next few years. Physicists expect the LHC to produce evidence for the Higgs particle that is hypothesized to be responsible for generating the mass of all matter. In addition, theoretical arguments point toward the possibility of discovering a new symmetry known as supersymmetry at the LHC, in the form of new particles that are partners to the currently known particles, and some of these new