**Minutes of the 2nd ApPIC (IUPAP/WG10) meeting in connection with the 2nd meeting on Large Neutrino Infrastructures**

Present E. Coccia, N. Mondal (part time because of ICFA neutrino panel), N. Roe, A. Olinto, C. Spiering, M. Spiro (chair)

Observers: S. Katsanevas, A. Kouchner (part time), J. Siegrist, K. Turner

After welcoming the participants to the meeting, the chair reminded that K. H. Kampert becomes ex-officio a new member of ApPIC as chair of the C4 IUPAP Commission (which for instance organizes the ICRC Conference).

The meager attendance, this time, was noted and discussed.

**Matters arising**

The chair reported on the presentation of the slides prepared during our first meeting, to APIF (global forum of funding agencies), to ApPEC (European Consortium forum of funding agencies on Astroparticle Physics), to Dubna JINR (Scientific Council). The reactions were very positive on Data Policy for multi-messenger astronomy, with a green light to test the statements and maybe go further (Dark matter and double beta decay) with the community, taking into account existing practices and recommendation in nearby domains (space, astronomy, particle physics). Concerning the recommendation on a balanced approach to multi-messenger astronomy, the reactions were mixed. Certain agencies objected that gamma-ray astronomy deserved a special attention in view of the very large foreseen investments (CTA).

Next presentations of the conclusions of our first (and second meeting) will be shown to the community in ICRC and in TAUP2015. The attending ApPIC members are invited to meet during these meetings.

**What can we learn from cosmology on neutrinos**

N. Roe made a presentation, which was followed by a long and lively discussion. The present limits on neutrino masses and number of species are:

–∑ mν < 0.25 eV (95% CL) from combination of Planck + BAO

–∑ mν < 0.14 eV (95% CL) from Ly-alpha forest + CMB+ BAO

– Planck 2015: Neff = 3.15 +/- 0.23, consistent with the SM prediction.

Cosmology develops very vigorously and one may expect new constraints (or measurements) of neutrino masses and number of neutrino species.

In the future these limits will improve significantly to < 20 meV (1sigma ) and may allow detection of ∑ mν determination of the mass hierarchy with two or more independent probes:

–DESI matter power spectrum

–S4 CMB polarization + DESI BAO

–Galaxy lensing from LSST/Euclid

Cosmology will test SM prediction of Neff = 3.046 to +/- 0.02

Cosmology measurements are complementary to reactor and accelerator experiments, 0v2b experiments, and beta-decay experiments. If the minimal neutrino sector (sum of neutrino masses=58mEV and number of species=3.046 is not detected, it would imply something is broken in the Standard Model of cosmology.

We recommend increased dialogue between these communities

**High Energy Astronomy , Relationship with the GZK cut-off**

A. Olinto showed the last results of IceCube and of Auger/Telescope Array. Do we see the GZK (more precisely: BZ like Berezinsky-Zatsepin) neutrinos (neutrinos produced by the highest energy Cosmic Rays hitting the microwave relic background)? The prediction limits in the EeV range were shown. The highest IceCube events are in the PeV range. Only the next generation of neutrino radio detectors will be able to fully address the GZK/BZ energy range (IceCube expects < 1 of these events per year and has not yet seen a single one).

 **Pingu and Orca: mass hierarchy from atmospheric neutrinos**

A. Kouchner gave a presentation on the potential and comparison of PINGU and ORCA, deep and dense arrays under the ice and under the Mediterranean sea. The slides are available on indico. C. Spiering drew the final conclusions on this presentation and comparison:

•PINGU and ORCA have very different systematics – highly complementarity!

•Both can reach ~ 3σ after 3 years (assuming θ23 in the first octant, otherwise faster), and may be the first detectors to establish the mass hierarchy.

•PINGU and ORCA will continue their successful cooperation on systematic effects and significance calculation.

•Prototype results from 6 strings ORCA expected in 2016/17

•Milestone 2017/18: Comparative process on science and technology, in particular the performance of prototypes and systematics.

•Very likely that two detectors at 2 different sites turn out to be the optimum approach, rather than one detector of double size at one site.

**Astroparticle physics capabilities from accelerator based neutrino experiments**

This discussion which took place at the end of the meeting was focused on the preparation of a table to compare p-decay, SN, atmospheric, solar and geo neutrinos detection capabilities of the three future detectors: DUNE (Liquid Argon Long Baseline Neutrino Experiment in the US), HyperK (Water Cerenkov Mton detector), JUNO/RENO (Large Scintillator detectors). The comparison is shown in the slides of the presentation of ApPIC to the 2nd Large Neutrino Infrastructure meeting two days later. Two extra columns should have been added (IceCube/KM3NeT and INO).

 **Presentation to the 2nd Large Neutrino Infrastructure meeting**

The presentation (slides on indico) was discussed.

Note after the meeting: after the presentation, many questions arise on data policy (mixed opinions, from very positive to very negative). In the USA, data policy is defined by their funding agencies and are far-reaching. The recommendations on cosmology were well taken and there were no further comments on PINGU/ORCA, except that the two collaborations are indeed working closer and closer.

The next ApPIC meetings will be during ICRC (beginning of August Den Haag) and TAUP2015 (beginning of September Torino). Another one will be scheduled, first semester of next year in Japan, together with the 3rd meeting on Large Neutrino Infrastructures.

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