

Notes from the 5th Axion Strategy Meeting

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This note contains a brief summary of the informal discussions which took place during the *5th Axion Strategy Meeting* held on the last day of the 7th Patras Workshop.

1 Introduction

The ending day of the 7th Patras Workshop was marked by the *5th Axion Strategy Meeting (ASM)*, which continued a series of informal round tables started in January 2009 at CERN. The second ASM was held in Durham, also in 2009, at the end of the 5th Patras Workshop, while the third Axion Strategy Meeting took place during the "Axions 2010" conference held in January 2010 in Florida. Finally, the 4th ASM was hosted in the 2010 6th Patras Workshop in Zurich. The 5th Axion Strategy Meeting came after a one year interval, which was agreed upon as a more meaningful time span between meetings.

The originally formulated "mission statement" of the strategy meeting was to "provide a round table environment for the community of physicists, both theorists and experimentalists, working in axion, and more generally in WISP physics, to freely float ideas and informally discuss them in order to discern the global trend of the field and identify interesting and promising directions for future developments."

This format has proved valid and fruitful in the course of the series. The 5th ASM was widely attended and the discussion was more than lively, touching all the fundamental themes of the field, seeing also the active participation of the younger attendants to the 7th Patras Workshop.

2 Notes from the discussion

It has become clear in occasion of the 5th ASM that the "Axion Strategy" title no longer completely covers the spirit of the discussion, since in recent times the field of interest has widened considerably to include objects such as hidden photons (paraphotons) and chameleons, giving full meaning to the WISP acronym. For these and other particles, research is moving beyond theoretical formulations and initial "parasitical" searches on to well-aimed experimental detection efforts. This was widely recognized as a very welcome development, both from a scientific point of view and from the point of view of the never ending search for funds.

The 5th ASM was also marked by the participation of several researchers working in the WIMP field, who stayed on after attending the Patras Workshop sessions. This is a clear signal that the central problem of identifying all the unknown constituents of the universe is starting to be seen more and more as a unitary scientific quest having several complementary aspects.

One of the recurring themes of past strategy meetings was the perception of the need to form a more closely tied community of physicists working in the WISP field. This goal appeared closer during the meeting. Here the discussion evidenced the ties between existing experimental groups, as in the case of the ALPS-CAST contacts or of the forming group in the US centered on the Fermilab facilities, and the coagulation of large scale international collaborations to start future advanced projects, as in the case of the next generation axion helioscope. This trend in the WISP community follows the successful ones in the WIMP community, where, for instance, a data sharing program has been started between the CDMS and EDELWEISS experiments, and in the gravity wave community, where a large "world observatory" has been formed by coordinating data taking and by sharing data between VIRGO and LIGO.

There was unanimous agreement that Konstantin Zioutas must be specially thanked for his successful efforts in bringing the WISP community together, both physically and intellectually.

Almost all active experiments and all future ones plan to search for chameleons or hidden photons, or both. ADMX, for instance, intends to search for chameleon interactions. There are also ideas to look for hidden photons with microwave cavities, while the SHIPS collaboration in Hamburg will soon start directly searching for hidden photons emitted by the sun. In addition, other WISPs, such as Mini Charged Particles, could be produced and detected with a light-shining-through-a-wall (LSW) scheme. The search for axions, however, particularly for the QCD axion, is still the mainstream of the WISP field. In fact axions are also very often searched for "parasitically" in WIMP and neutrino experiments.

From a theoretical point of view, it was pointed out that axions are still Dark Matter candidates even in the case of a "nightmare scenario" at LHC, where nothing is found after the available energy range is explored. The axion case is also reinforced by Pierre Sikivie's opinion that the bulk of DM is made up of axions. This view sparked a discussion on whether galactic axions form Bose-Einstein condensates and caustics, resulting in an impact on observatory-type searches. Astrophysics proved again a source of surprises: many comments centered on the so-called "White Dwarf" data, based on the observation of cooling rates, which point at an axion coupling to electrons of $g \approx 2.24 \cdot 10^{-13} \text{ GeV}^{-1}$ with a mass $\approx 8 \text{ meV}$. This mass value would interestingly place QCD axions right within "the gap" in the axion-photon-coupling vs. mass plane, where no present experiment has yet access.

Regarding detection techniques, the main avenue of approach remains as always the axion coupling to photons, thus the stress is placed more than ever on low background single photon detection at all the energies of interest, such as eV scale for LSW experiments, or keV scale for observatories such as CAST. The other interesting technique also unfolding in the WISP field is cryogenics, both as a way to access the superconducting regime, as in cavity experiments, and as a direct way to minimize detector background.

As a final note, it must be pointed out that the *CAST barrier*, that is the experimental bound set by CAST in the axion-like particles parameter space, is still the standard towards which present and projected experimental performances are compared.

3 Conclusions

The series of informal, round table style, Axion Strategy Meetings continued successfully in Mykonos with the 5th ASM having rising attendance and intense discussions. The present meeting, while touching all the main subjects in WISP research, above all gave all present a real sense of a community sharing ambitious scientific goals and the strong will to attain them.

If a personal view is allowed here, it is my opinion that this should be regarded as the most important outcome of the 5th Axion Strategy Meeting.

4 Acknowledgments

A heartfelt thank you goes to all colleagues who took the time and put in the effort to actively participate in the 5th Axion Strategy Meeting, making it a worthwhile addition to the 7th Patras Workshop.