WG4 - PLANS

C GATTI - M KARUZA

Mailing list WG4: cosmicwisperwg4@lists.infn.it

Kick Off meeting Agenda https://agenda.infn.it/e/CosmicWispersKickOff

Discuss today: WG organization
Marin's Talk: State of Art of WG4 (prepare one slide on your experiment/activity for Marin)

Thursday 23th

09:00 **Welcome** — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 09:00 - 09:10

The Cosmic Wispers COST Action — *Alessandro Mirizzi* — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 09:15 - 09:45

10:00 **WG1** — *Michele Cicoli* — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 09:50 - 10:20

Coffee Break — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 10:25 - 10:45

11:00 **WG2** — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 10:45 - 11:15

WG3 — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 11:20 - 11:50

12:00 **WG4** — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 11:55 - 12:25

WG5 — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 12:30 - 13:00

13:00

14:00

Talks by WG leaders

Plans and organizations of WGs

15:00 **WG1** — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 15:00 - 15:30

WG2 — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 15:35 - 16:05

16:00 **Coffee Break** — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 16:10 - 16:30

WG3 — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 16:30 - 17:00

17:00 **WG4** — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 17:05 - 17:35

18:00 **Atom interferometry** *Philipp Haslinger*; **WG1** *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* 18:00 - 19:00; **WG2** *Seminari, LNF* 18:00 - 19:00; **WG3** *Salvini, LNF* 18:00 - 19:00; **WG5** *B-1, LNF* 18:00 - 19:00

19:00

Talks by WG co-leaders

State of art of WG activity

Friday 24th

09:00 **Haloscopes** *Alessio Rettaroli*; **Magnetometers** *Grujic Zoran*; **WG1** *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* 09:00 - 11:00; **WG2** *Seminari, LNF* 09:00 - 11:00; **WG3** *Salvini, LNF* 09:00 - 11:00; **WG5** *B-1, LNF* 09:00 - 11:00

10:00 **Helioscopes** *Marin Karuza*

11:00 **Coffee Break** — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 11:00 - 11:20

Round Table — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 11:20 - 13:00

12:00

13:00

Parallel sessions

Round table on COST organization

Technology Forum "Strong magnets for WISPs"

14:00

Introduction — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 14:30 - 14:40

15:00 **The Babylaxo Magnet** — *Matthias Mentink* — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 14:45 - 15:15

The MADMAX Magnet — *Walid Abdel Maksoud* — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 15:20 - 15:50

16:00 **High magnetic field facility in Grenoble** — *Pierre Pugnat* — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 15:55 - 16:25

IRIS — *Lucio Rossi* — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 16:30 - 17:00

17:00 **Coffee Break** — *Aula Touschek, Laboratori Nazionali di Frascati (Rome), Italy* — 17:05 - 17:25

Tasks.

T4.1: Review of present and future WISPs experiments (including DM ones) in order to assess their discovery potential.

- **Subtask 4.1.1**: Perform an update of summary plots of present limits for various WISPs models (axion, hidden photons, chameleons etc.). For the axion constraints on the coupling with photons, electrons, nucleons. For HP, bounds on the kinetic mixing angle.

Reinterpretation of existing experimental limits with new WISPs models.

- **Subtask 4.1.2**: Combination of experimental results with astrophysical and cosmological limits to extract summary plots.
- **Subtask 4.1.3**: Highlight regions of the parameter space not yet covered by experiments and discuss feasibility of the experimental searches in these regions. Discuss the feasibility of testing all the couplings (to leptons, photons, baryons etc.) in all the parameter space.

T4.2: Identify progress need in the key technologies and techniques (data analysis, signal filtering) for present and future experiments needed to cover the theoretically motivated region in the parameter space.

- **Subtask 4.2.1**: perform a survey of technology (materials, detection, sources, cryogenics, magnets, high resolution detectors) needed in WISP experiments.
- **Subtask 4.2.2**: perform a survey of solutions available (in SME or academic research) and of the competences available.

Activities [WG1-4]:

- Organization of workshops on specific topics of the WGs.
- Organization of Short Term Scientific Missions (STSM).
- Organization of Technology Forums (WG4).
- Publication of report on the scientific results in the webpage (in cooperation with WG5).
  Participation in outreach activities (in cooperation with WG5).
- Preparation of the final White Paper and of the Training School Lecture Notes.

Milestones [WG1-4]: WG meetings to track the progress of each WG and to take corrective measures in case of problems.

Deliverables:

D4.1 Draft Report on direct detection (month 12)

D4.2 Interim Report on direct detection (month 24)

D4.3 Final Report on direct detection

D4.4 Report on Technologies Forums

WG4 - Plans

General organization:

1. Monthly meeting (one per month?)
2. Report repository (Overleaf? Drive?) Latex/Word
3. WG4 documents (Drive? Dropbox?)

First year plan:

1. Make a list (bibliography) of wisps models (from wg1): Axions/alps, hidden photons, chameleons, string moduli …
2. Make a list (bibliography) of experiments/detection techniques used for wisps searches.
3. Make a dictionary of WISPs models (contribute to https://en.wikipedia.org/wiki/WISP_(particle_physics) ?)
4. Contact experts in specific experiments/techniques within and outside the COST. In case, invite them to join the COST.
5. Make a list of technology needed by experiments
6. First Report draft

Experiments/Techniques:

Helioscopes
Haloscopes
LSW
AMO
Magnetometers
5^{th} Force exp.
Casimir
Torsion balance
Atomic tests
Levitated microspheres
Micro resonators
GW Interferometer
Atom Interferometer
Neutron interferometry
Cold neutrons
Colliders
Beam dump/on target
Underground
Polarization experiments
Variation of fundamental constants
…

Particle/Models list:

Axions
ALPS
Relaxion
Hidden Photons
Chameleon
Symmetron
Moduli
Dilatons
Radion
MeV right-neutrino
Sterile neutrino
Majoron
Familon
Mini charged particles
Fuzzy DM
…

Recent reviews:

https://arxiv.org/abs/2203.14915 (Snowmass)
https://arxiv.org/abs/2102.12143 (FIPs 2020)

What is missing? Where/How can we improve?
Combine with wg1-2-3 outputs (new models; DM preferred regions; Astro-limits; …)

1. Editors for the Report
2. Contact person for experiments
3. Contact persons in wg1-2-3 (somebody already in wg1-2-3?)

Fill the document here:

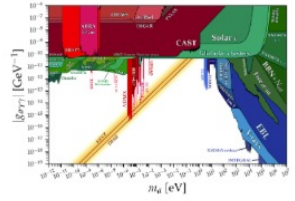
https://docs.google.com/spreadsheets/d/16Uc43KXxWPGfMJSjA-lle4gDhvI4aRrzWl8vJimIC6s/edit?usp=sharing

For summary plots it would be nice to use this software from Ciaran O'Hare (COST member)

https://cajohare.github.io/AxionLimits/

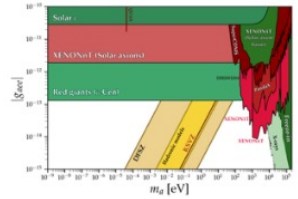
Axion-photon coupling

Data files
Plot (pdf, png)
Plot with projections (pdf, png)
Plot of dimensionless coupling (pdf, png)
Plot of dimensionless coupling with projections (pdf, png)



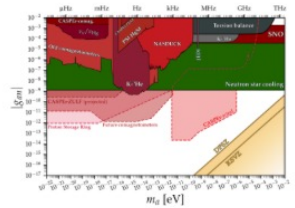
Axion-electron coupling

Data files
Plot (pdf, png)
Plot with projections (pdf, png)



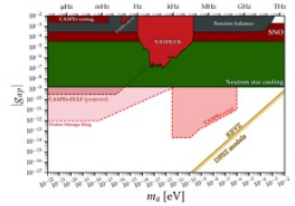
Axion-neutron coupling

Data files
Plot (pdf, png)
Plot with projections (pdf, png)



Axion-proton coupling

Data files
Plot (pdf, png)
Plot with projections (pdf, png)



D4.1 Draft Report on direct detection (month 12)

Tentative agenda:

- February: List of editors; Latex/Word template (drive or overleaf)
- March-June: Meeting to define Report index/sections. Identify Editors for each section. Collect bibliography. Collect list of particles/models/experiments. Updated results for plots/limits. Combine experiment results. Inputs from other WGs.
- September-October: First draft; Identify missing models/experiments. Invite experts to join COST.
- December: Draft Report on direct detection (State of Art)

Meeting outcomes

- Contact person with CERN-PBC Technology working group → Giovanni Cantatore, Pierre Pugnat (will report the activity of PBC WG) https://pbc.web.cern.ch/
- ECFA Quantum sensing wg (Lamanna for info. Find a contact person) (https://indico.cern.ch/event/1229782/program)
- Use INDICO for meetings (Alessandro Mirizzi will create COST INDICO page)
- Use Overleaf and LATEX

WG contact persons:

- WG1 Mario Reig
- WG2 Jose Cembranos
- WG3 Maurizio Giannotti, Federico Urban
- WG5 Loredana Gastaldo, Serkant Ali Cetin

One WG4 meeting per month
We will try to have a fixed day (make a doodle first time)
Documents on Drive and/or INDICO page of COST action
Next WG4 meeting during the parallel session of the Kick Off meeting in February