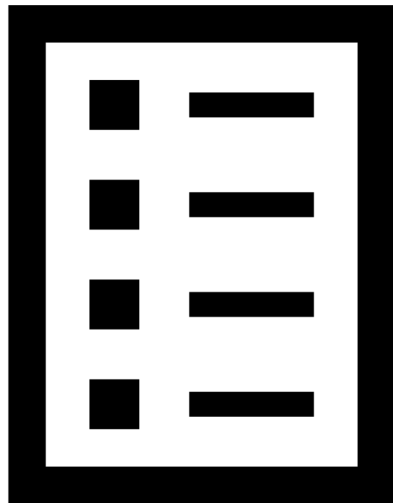




WG4 – DIRECT WISP SEARCHES

C GATTI - M KARUZA



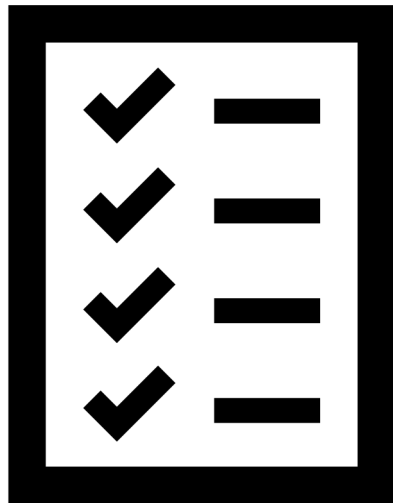
Tasks

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 [WG I-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 [WG I-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 - General organization



- WG4 meetings one per month



- Report on direct detection and Tech. Forums: Overleaf LATEX



- WG4 documents on Drive/Dropbox



- Mailing List cosmicwisperwg4@lists.infn.it
- INDICO meetings <https://agenda.infn.it/category/1831/>

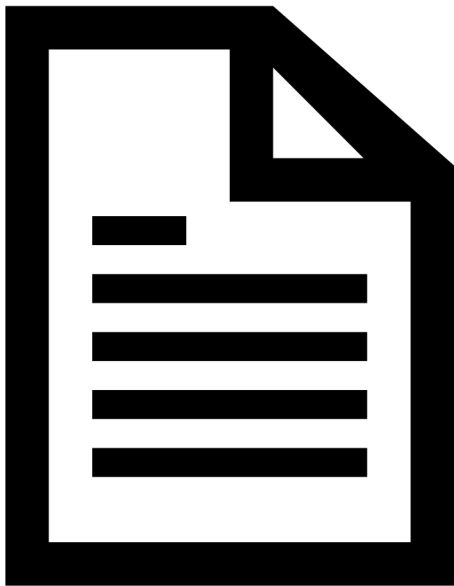
If you want to contribute to the Reports or be a contact person for an experiment, fill this module:

<https://docs.google.com/spreadsheets/d/16Uc43KXxWPGfMJSjA-lle4gDhvl4aRrzVl8vjimlC6s/edit?usp=sharing>

Contact Persons



- WG contact persons:
 - WG1 Mario Reig
 - WG2 Jose Cembranos
 - WG3 Maurizio Giannotti, Federico Urban
 - WG5 Loredana Gastaldo, Serkant Ali Cetin
- Contact person with CERN-PBC Technology working group: Giovanni Cantatore, Pierre Pugat
- Contact person with ECFA Quantum Sensing WG (tbd)



Recent reviews

<https://arxiv.org/abs/2203.14915> (Snowmass)

<https://arxiv.org/abs/2102.12143> (FIPs 2020)

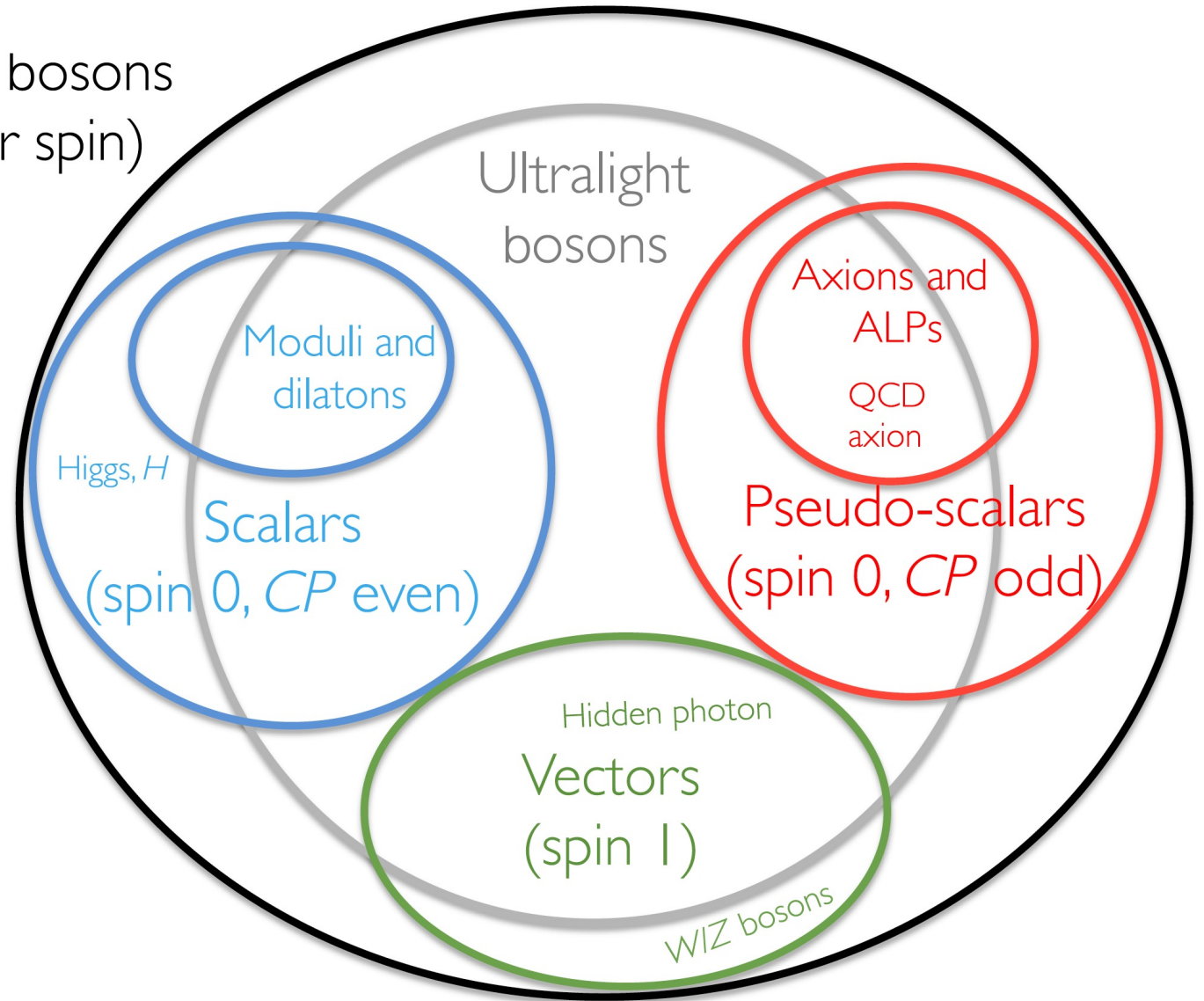
- What is missing?
- Where and how can we improve?

Improve with new models, observables, theory indications on DM and new experimental results and experiments → Inputs from WGI-2-3

Inputs from WGI

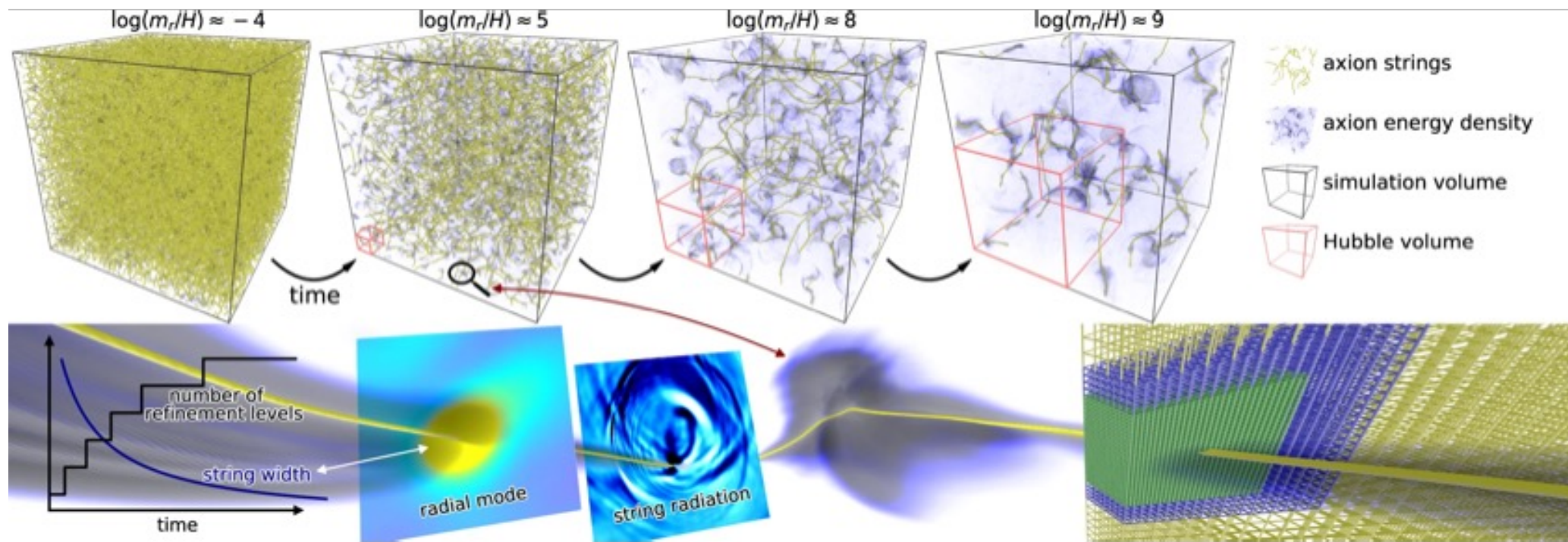
Models

Massive bosons
(integer spin)

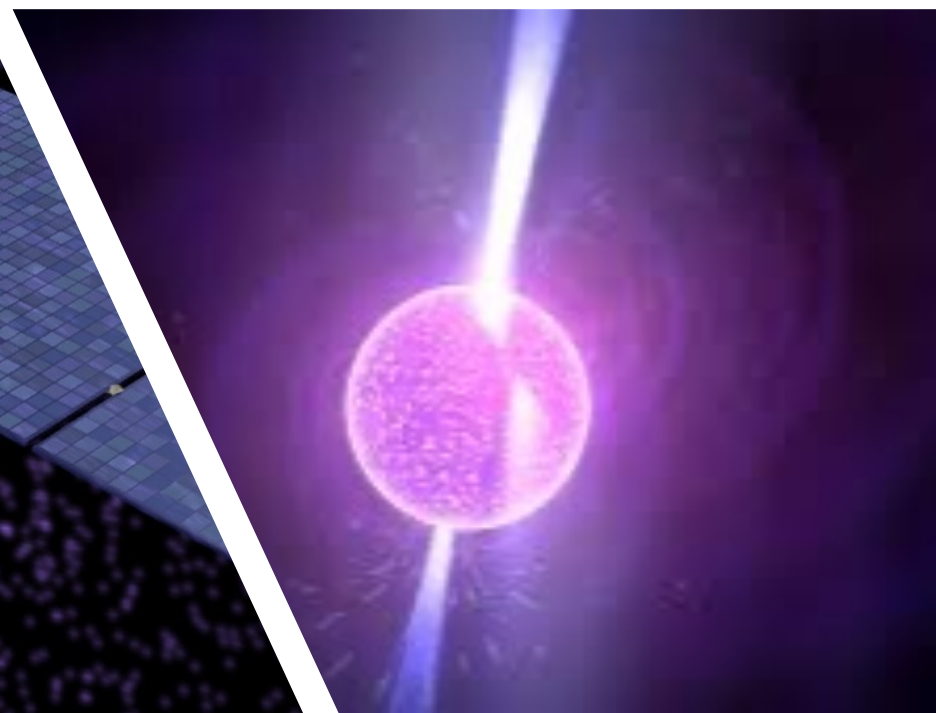
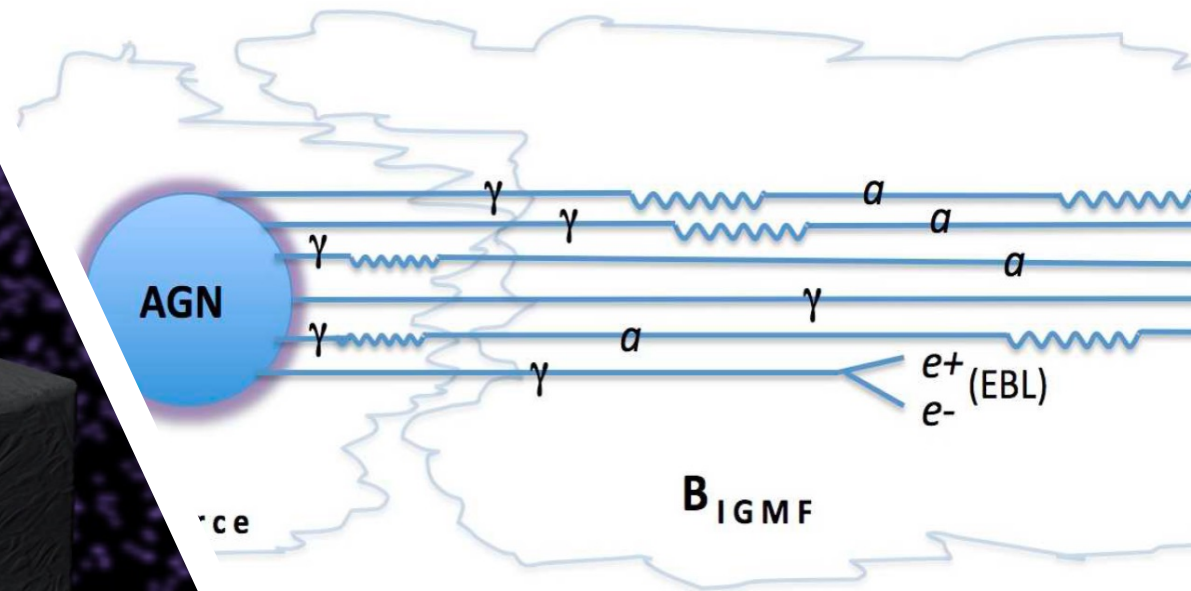
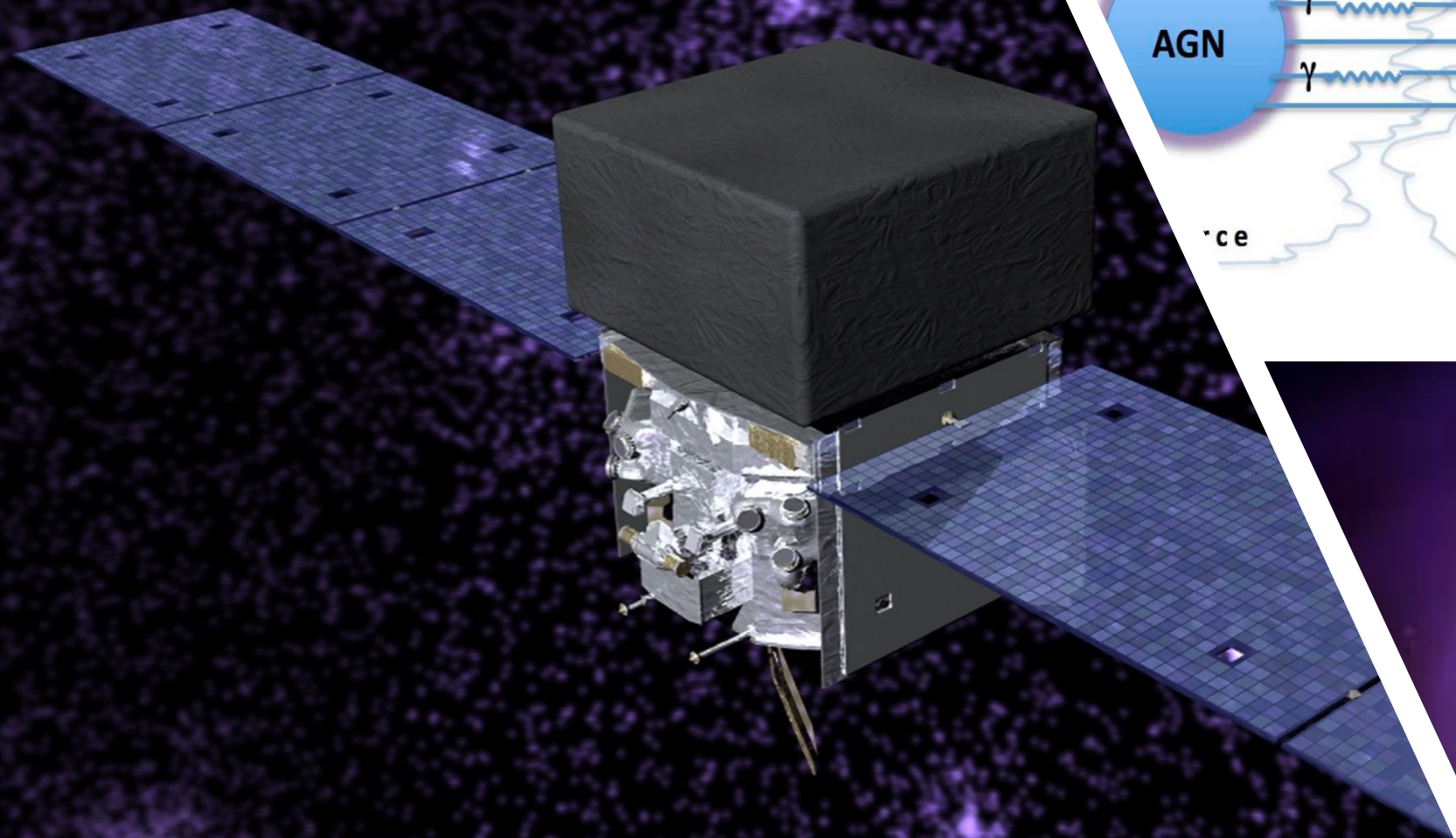


Inputs from WG2

Preferred parameter space for WISP dark matter candidates



Inputs from WG3

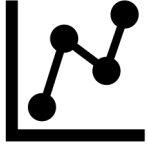


Astrophysical experimental results (hints or limits)

Experiments and Techniques



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



Plots for Exclusion Limits

We will use the software from Ciaran O'Hare (COST member)

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

Ciaran's project already rich of data on limits for several couplings of WISPs. We can help to extend the physics case, collect data and create new summary plots. Will organize a subworking group on this.

Axion-photon coupling

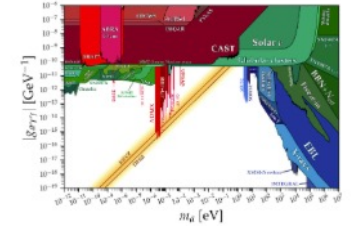
Data files

Plot (pdf, png)

Plot with projections (pdf, png)

Plot of dimensionless coupling (pdf, png)

Plot of dimensionless coupling with projections (pdf, png)

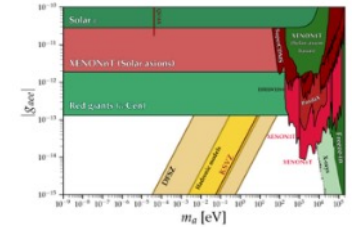


Axion-electron coupling

Data files

Plot (pdf, png)

Plot with projections (pdf, png)

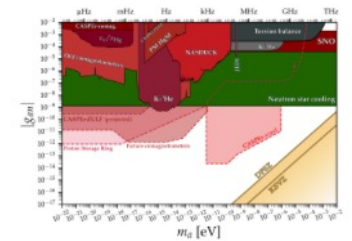


Axion-neutron coupling

Data files

Plot (pdf, png)

Plot with projections (pdf, png)

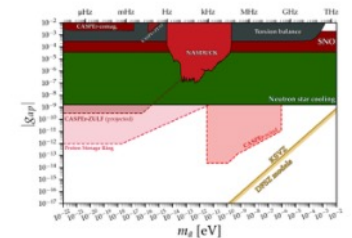


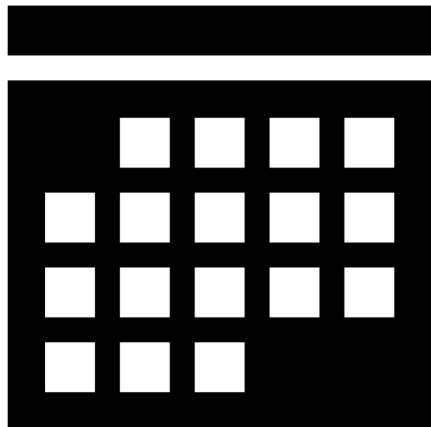
Axion-proton coupling

Data files

Plot (pdf, png)

Plot with projections (pdf, png)

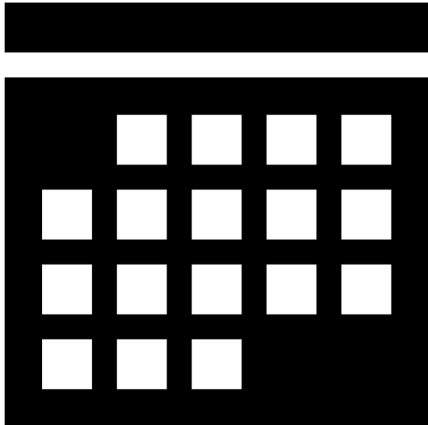




First year plan

- Make a list of WISPs models
- Make a list of WISPs experiments
- Preliminary Summary Plots
- Contact experts in specific experiments and techniques within and outside the COST. Invite them to join the COST.
- Make a list of technology needed by WISP experiments
- Draft of Direct Search Report

D4.1 DRAFT REPORT ON DIRECT DETECTION (MONTH 12)



Tentative agenda

- February: List of editors; Latex/Word template
- 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)

The End