Forum on New Results from WISP Searches.

DESY Physics Seminar, 3/4 December 2013, Hamburg/Zeuthen

Michael Betz (CERN): Results of the CERN Resonant WISP Search (CROWS)

Matthias Schwarz (Hamburg Observatory): Results of the Solar Hidden Photon Search (SHIPS)

Andrei Lobanov (MPIfR and UHH): Results of the WISP Dark Matter Experiment (WISPDMX)

HELMHOLTZ ASSOCIATION

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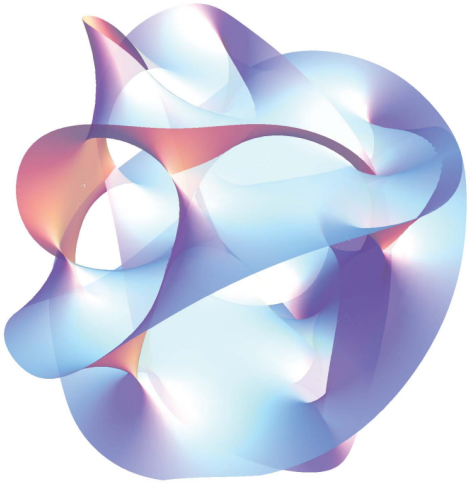
Why?

- Growing physics case for very Weakly Interacting Slim Particles (WISPs), such as axions, Axion-Like Particles (ALPs) and Hidden Photons (HPs):
  - In many theoretically appealing extensions of the Standard Model, WISPs occur automatically



- Axions and ALPs: Nambu-Goldstone bosons from the breaking of global U(1) symmetries at high scale
  - Axion from breaking of global chiral symmetry solving strong CP problem
  - Majoron from breaking of global lepton number symmetry
  - Closed string axions: KK zero modes of 10D antisymmetric tensor fields in string compactifications

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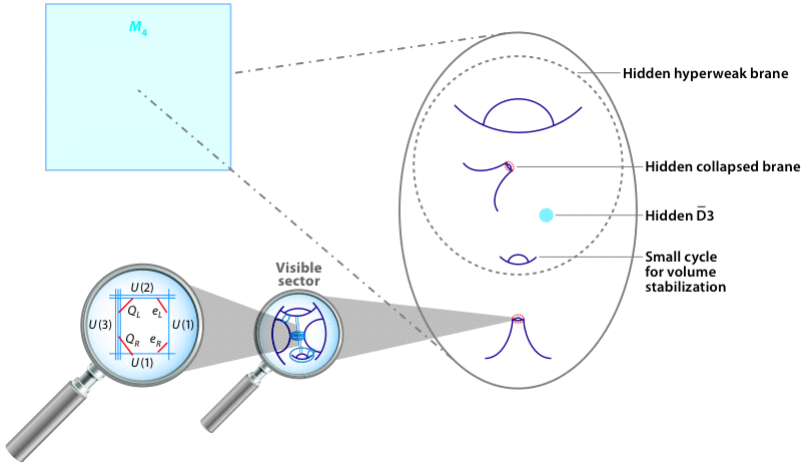
- HPs: vector bosons of a local U(1) gauge theory under which SM particles are uncharged
  - U(1) factors from breaking of grand unified gauge group
  - Often occur in low energy effective field theories from string theory



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  - WISPs are natural cold dark matter candidates

- WISPy cold dark matter non-thermally produced in the early universe in form of spatially homogeneous field oscillations = coherent state of non-relativistic WISPs
- Survives until today, if very weakly coupled, in particular to photons,

$$\mathcal{L} \supset -\frac{g}{4}\,\phi\,F_{\mu\nu}\tilde{F}^{\mu\nu}$$

$$\mathcal{L} \supset -\frac{\chi}{2}\,F_{\mu\nu}X^{\mu\nu}$$

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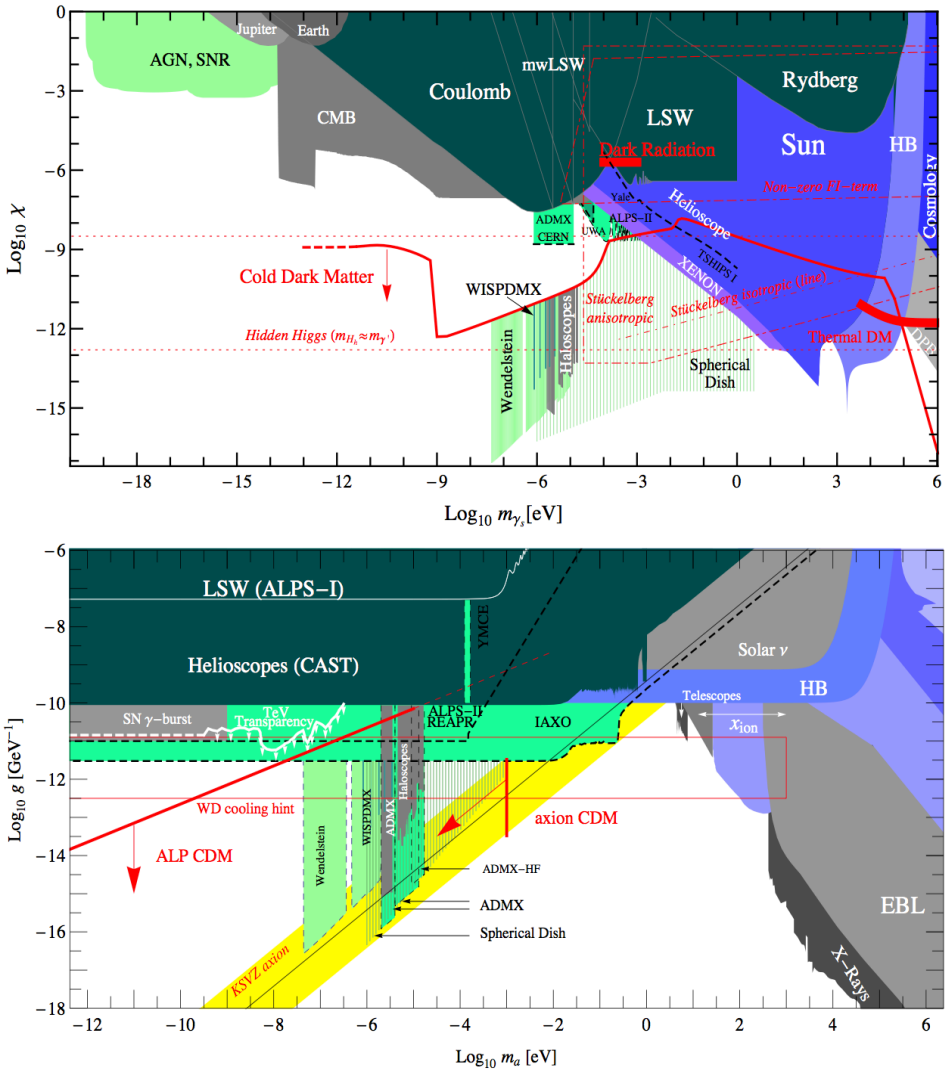

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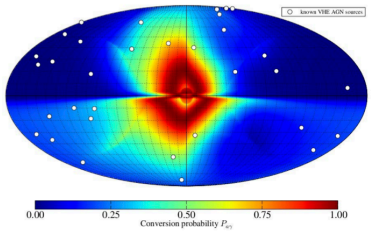
DESY
Physics Seminar

The opacity of the universe for gamma-rays.

Dieter Horns (Hamburg University)

Tuesday, 15 October 2013, 16:45 h
DESY Auditorium



Once stars started to form, the universe has become a complicated place in many aspects – one of them will be discussed here. The continuing injection and re-processing of stellar photons during the past 10 Gigayears has led to a universal optical/infra-red background field. Until now, it has not been possible to directly measure this faint glow of the extra-galactic background light (EBL). However, the EBL has recently been firmly detected in an indirect way: a clear signature of an exponential attenuation has been discovered in the gamma-ray spectra of active galactic nuclei (AGN). The spectral signature is consistent with the effect of pair-production processes. At sufficiently large attenuation, deviations are expected in the case of competing processes that circumvent the absorption. A number of studies indicate the presence of such an anomalous transparency for AGN at TeV energies using energy spectra obtained with ground based imaging Cherenkov telescopes. Recently, additional evidence for anomalous transparency has been reported using lower energy gamma-rays detected with the pair-telescope on-board the Fermi spacecraft. A number of interpretations have been suggested and are confronted with the measurements. A particularly interesting scenario requires the presence of an axion-like particle with a photon coupling and mass well within reach of future laboratory experiments using light-shining-through the wall setups (ALPS-II) or future helioscopes (IAXO).

- **Coffee, tea and cookies will be served at 16:30h**
- **After the seminar there is a chance for private discussions with the speaker over wine and pretzels**

Accelerators | Photon Science | Particle Physics

Deutsches Elektronen-Synchrotron
A Research Centre of the Helmholtz Association

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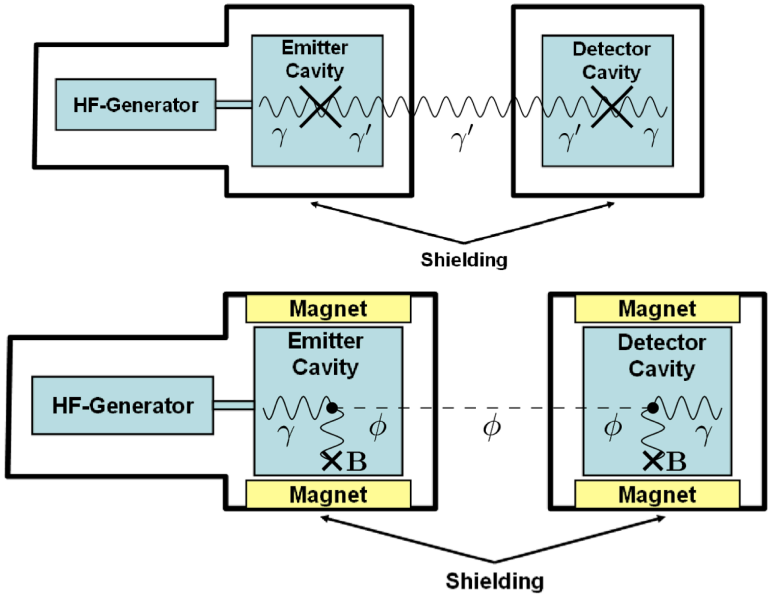
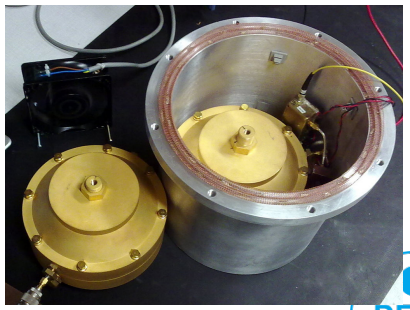
- Light-shining-through-a-wall or Microwave-cavity-shining-through-shielding experiments



  - CROWS:



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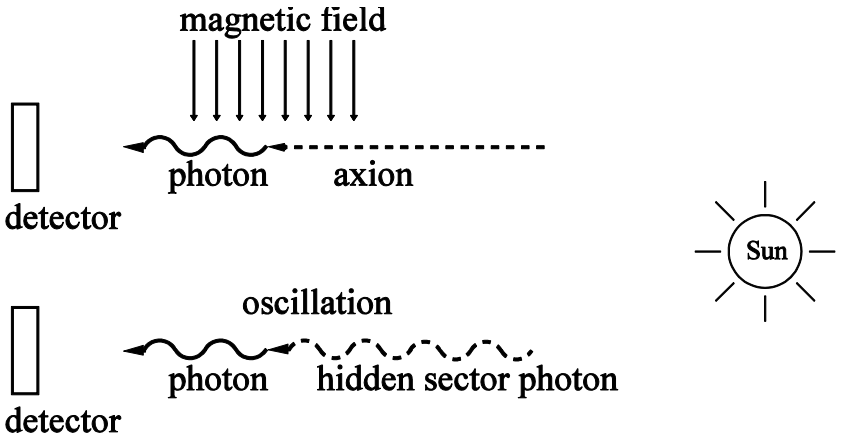
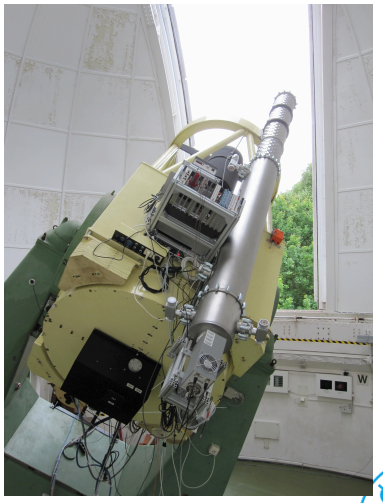
- Helioscopes:



- SHIPS:



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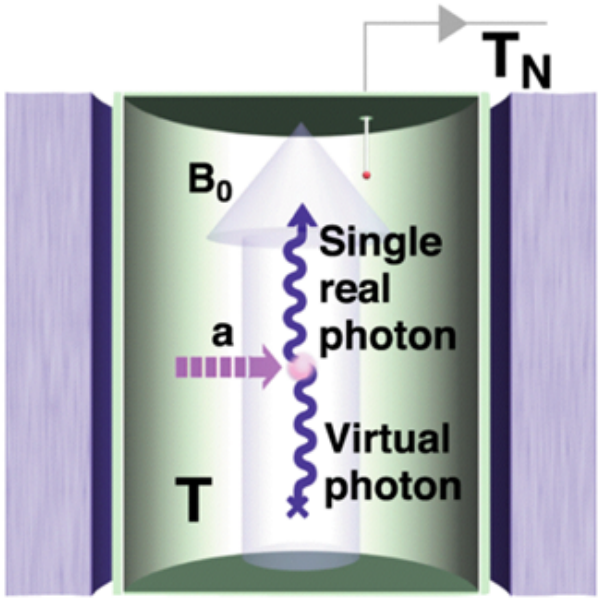
- Haloscopes:



  - WISPDMX: