

Ultralight DM at DESY?

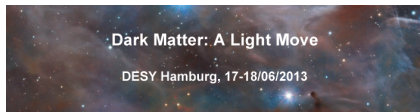
Yet another nice topic with yet again too little manpower

Babette Döbrich

WISPY coffee DM

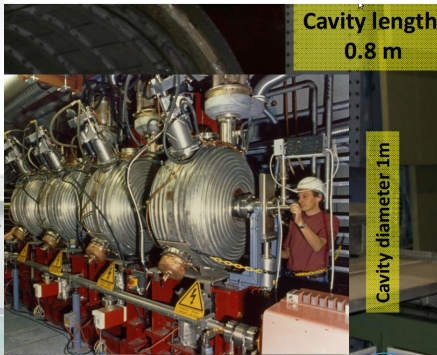
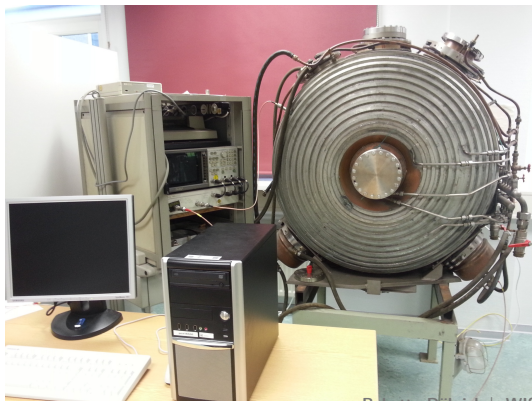
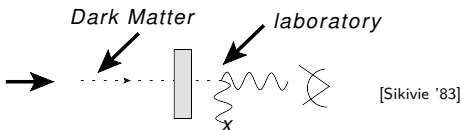
DESY, April 25th 2014

Intro: Good intentions

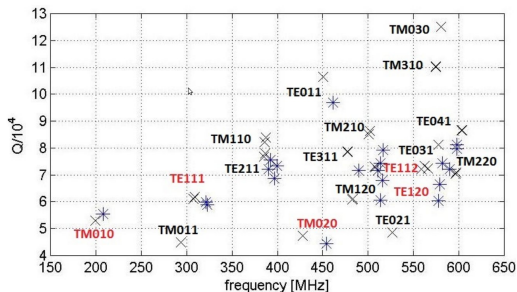


- > workshop \sim 1 year ago
- > short review of what has happend since

> 208 MHz HERA proton cavity as Haloscope

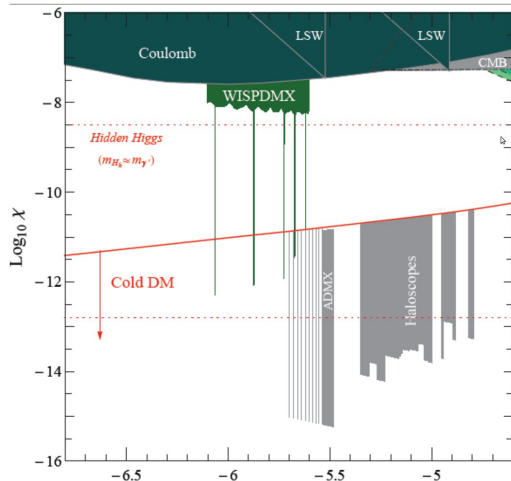


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- > phase 1 (ongoing) → **hidden photons** search at 'nominal cavity resonances'



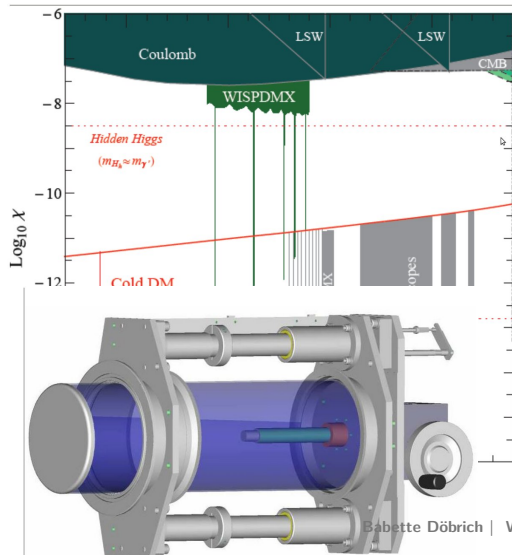
Mode	TM ₀₁₀	TE ₁₁₁	TM ₀₂₀	TE ₁₁₂	TE ₁₂₀	TM ₀₃₀
f/MHz	199	308	428	508	560	580
Q	53000	61000	47000	73000	72000	125000

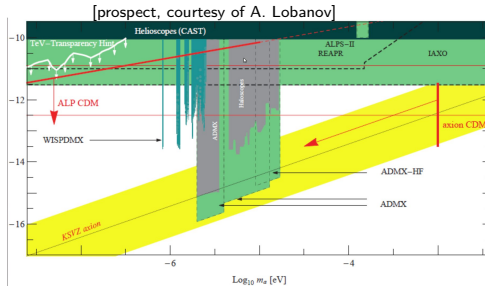
[preliminary result, courtesy of A. Lobanov]



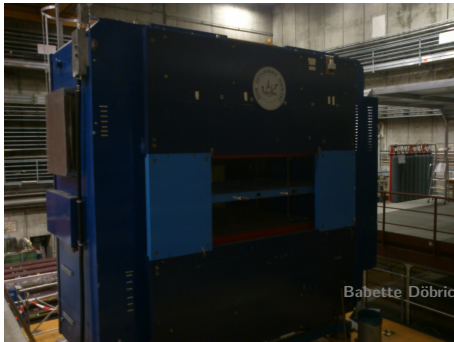
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- > phase 2 → cavity tuning (plunger in construction), ~ 60% of 200-500 Mhz range
- > phase 3 → B field?? HUGE V! H1 (supra 1.15T), Hermes (norm. cond. $\sim 1T$), CERN M1 (3T)
- > add. problem: geometry factor! ($\angle B, A$)

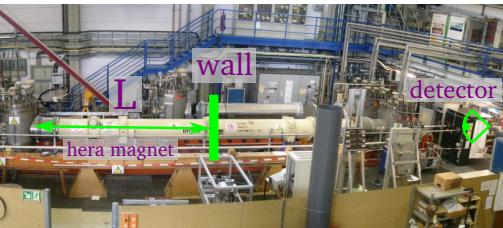


3rd life of HERA dipoles?

w F. Schaefer, E. Kreysa (MPIfR), F. Caspers (CERN)

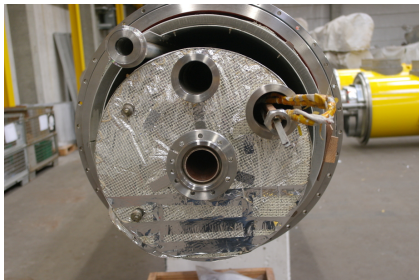


- > magnets straightening working & magnet ready at test stand, 5.3 T, 27l volume
- > waveguide H11 basic mode in OFHC (copper) beam pipe at ~ 3.2 GHz? (limits exist already)
- > option of placing a cavity dismissed: too little manpower, commercial waveguides lesser Q, unclear @ quench, idea: play & learn



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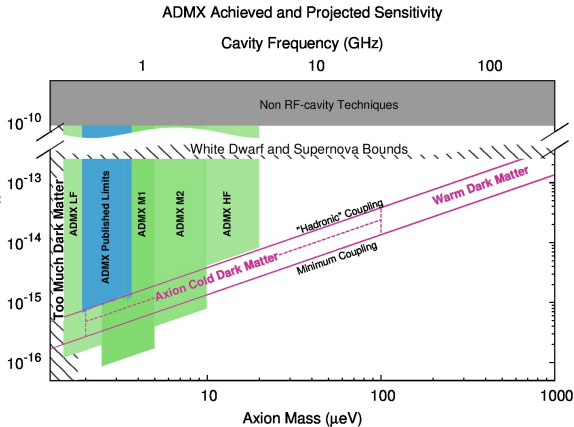


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- > endcaps under construction at MPIfR Bonn
- > practical problems: too large symmetry?



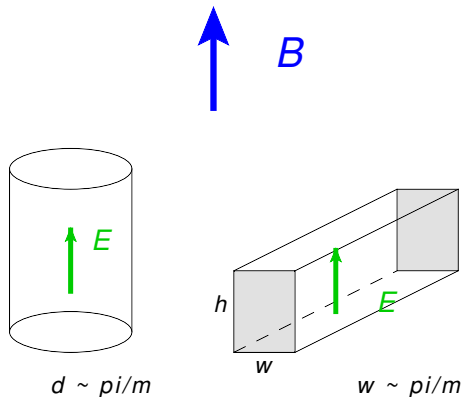
Further Haloscopes at higher masses?

- > existing experiments & ADMX HF leave out high masses, classical axion window



Pic from ADMX homepage

Further Haloscopes at higher masses?



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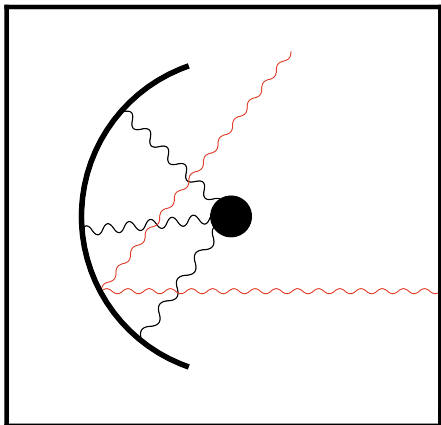
> decouple resonant frequency from V [1110.2180], long rectangular cavities? perfect for dipoles

> under construction? [Irastorza, Redondo (Zaragoza); Gimeno (Valencia), Gallego (Yebes)]

> problems: close mode spacing and more

Finding $U(1)$'s of a Novel Kind @ desY (FUNKY)

- > faster but less sensitive:
broadband search w/o
resonant enhancement:
collect light at center of
reflecting sphere Jaeckel/Redondo
more info:[1212.2970] and [1308.1103]

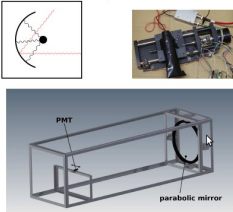


Finding U(1)'s of a Novel Kind @ desY (FUNKY)

Sumico Solar hidden-photon search L-mode hidden photons Hidden-photon DM search Sumi

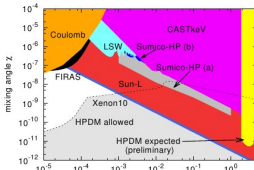
Hidden-photon DM search

[D.Horns, *et al.*, arXiv:1212.2970]



The diagram illustrates the experimental setup for hidden-photon dark matter (DM) search. It features a parabolic mirror (labeled 'parabolic mirror') and a photomultiplier tube (labeled 'PMT'). The setup is designed to collect light at the center of a reflecting sphere. A small inset image shows a photograph of the physical apparatus.

Expected sensitivity

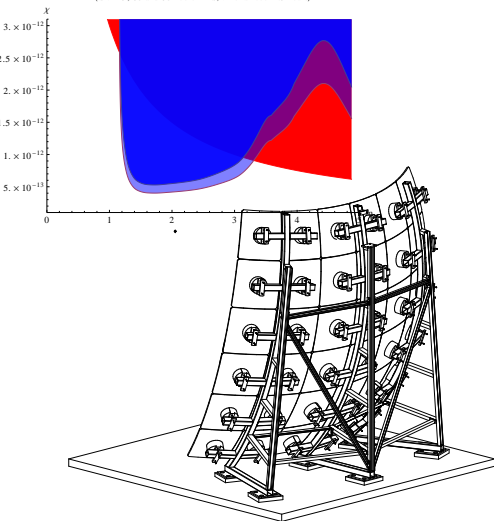


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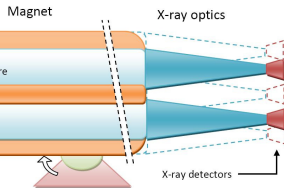
[with R.Engel (KIT), M.Kowalski (Bonn, Berlin & DESY Zeuthen)]

[SNR=3, 30 and 90 hours PIXIS, timeframes of 1.5 hours]



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more info:[1212.2970] and [1308.1103]
- > setup in Tokio (Y. Inoue @
Patras 2013),
- > first setup @ DESY with
AUGER spare in the visible
foreseen for mid/end 2014,
- > expected sensitivity (1.5-3)
eV down to $\chi \lesssim 10^{-12}$

Others: CAST (Zioutas et al) and IAXO (Iraistorza et al)



- > DM options still under discussion...
- > some slides of meeting with Y. Semertzidis (Kaist)
February 27/28: <http://alps.desy.de/e169399/>

