Light-shining-through-walls via virtual minicharged particles in a magnetic field

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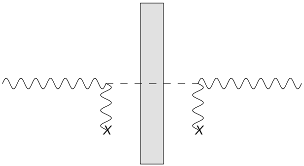
FSU Jena & Helmholtz Institute Jena

arXiv: not yet ☹ $\Rightarrow$ work in progress! ☺

7th Patras meeting
☼ Mykonos ☼
June 27th, 2011

1. Towards tunneling via virtual minicharged particles
2. (Preliminary) Discovery potential of LSW via virtual minicharged particles
3. Résumé

Light-shining-through-walls scenarios – an overview



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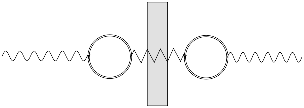

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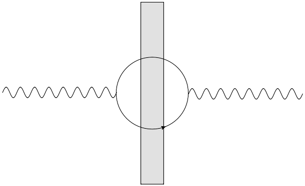

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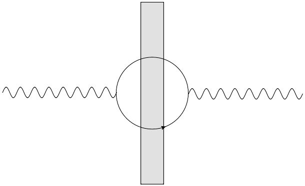

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(probably easier in experiment than in theory... ;))

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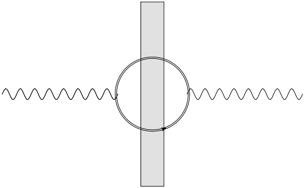

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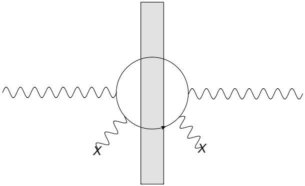

object of interest $\rightarrow$ the polarization tensor:
naive ansatz: perturbative treatment of the
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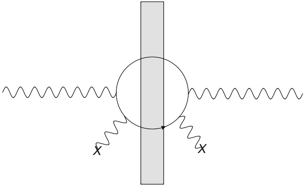

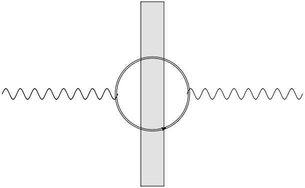

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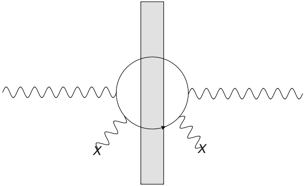

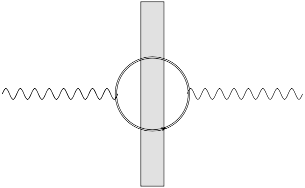

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$\theta = \sphericalangle(\vec{B}, \vec{k}) = 0$ & proper time integral managable! $\Rightarrow$ our choice (only chance)
[see talk by F.Karbstein on thursday!]

Polarization states at zero incidence

States of polarization for $\theta = \sphericalangle(\vec{B}, \vec{k}) = 0$

Polarization states: $\perp$ to B, & tilted: recall: $B \neq 0 \Rightarrow v \neq c$ (quasi-longitudinal – in transversal subspace!) $\rightarrow \llcorner$ [TsEr]

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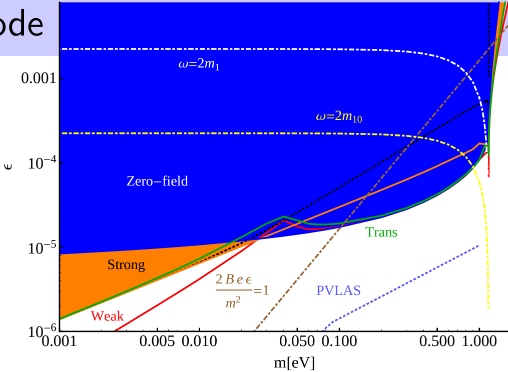
NB: Physics of the $\llcorner$ propagation mode

number of photons in the $\llcorner$ mode has yet to be determined: (what happens for $B = 0$ to $B \neq 0$?) $\Rightarrow$ Our strategy today: Assume maximum coupling to $\llcorner$ in the following and report again with full result!

Exclusion bounds for $\llcorner$ mode

- $\rightarrow$ $B = 5T$, $\omega = 2.33\text{eV}$
- $\rightarrow$ $n_{\text{in}}/n_{\text{out}} = 10^{25}$
  (as, e.g. at ALPS)
- $\rightarrow$ barrier thickness: 1mm, 1μm



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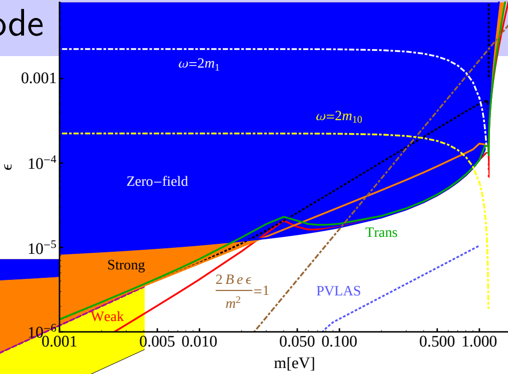

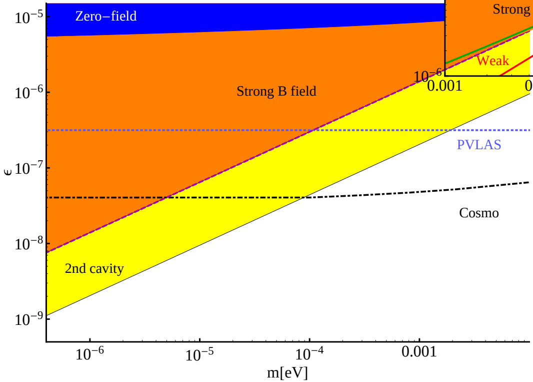

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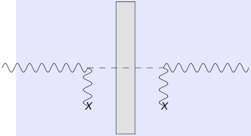

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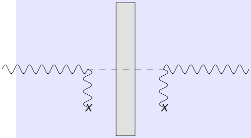

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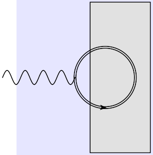

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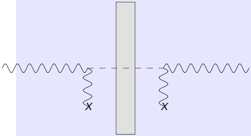

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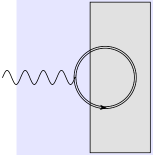

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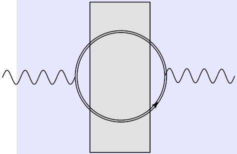

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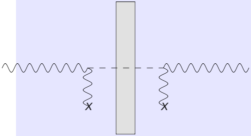
Physics of **low mass enhancement** (0th Landau level)



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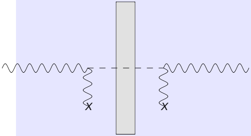

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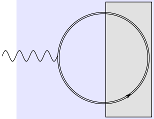

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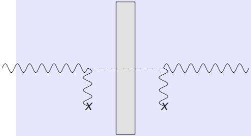

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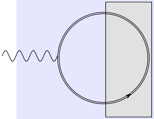

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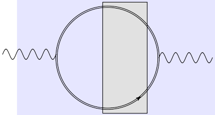

same "loop position" but larger Compton wavelength. Available "phase space" grows for lower masses
$\Rightarrow$ *one possible* interpretation of the low mass enhancement

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Summary & prospects

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