



Unresolved aspects* of simulating quantum squeezed noise

*really just a cry for help

Mikhail Korobko

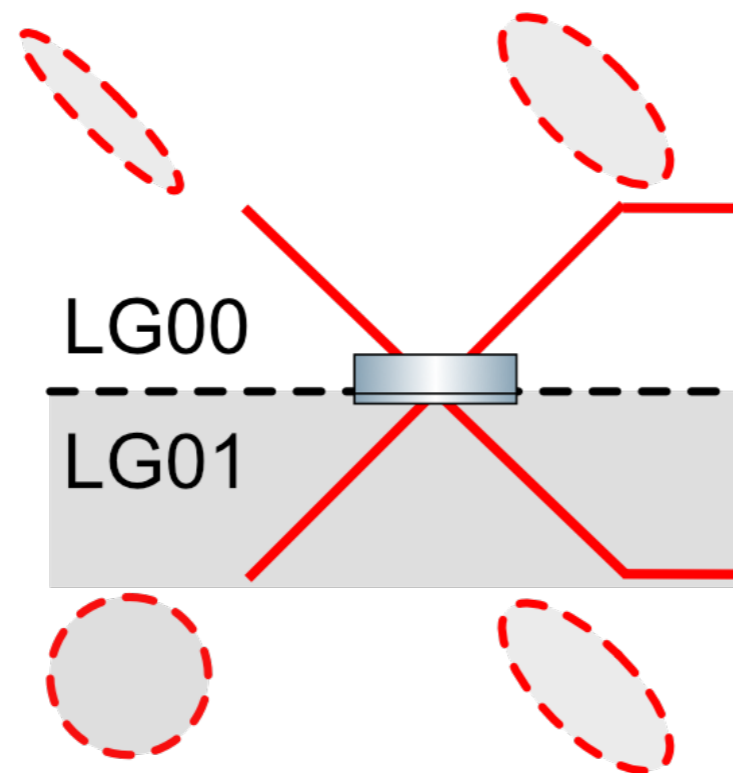
XIII ET Symposium May 2023

Disclaimer!

- ▶ I won't present new discoveries, but want to attract more attention
- ▶ Most of what I talk about is based on dev. version of pygwinc and discussions within SQZ WVP and with Stefan D. & Teng.

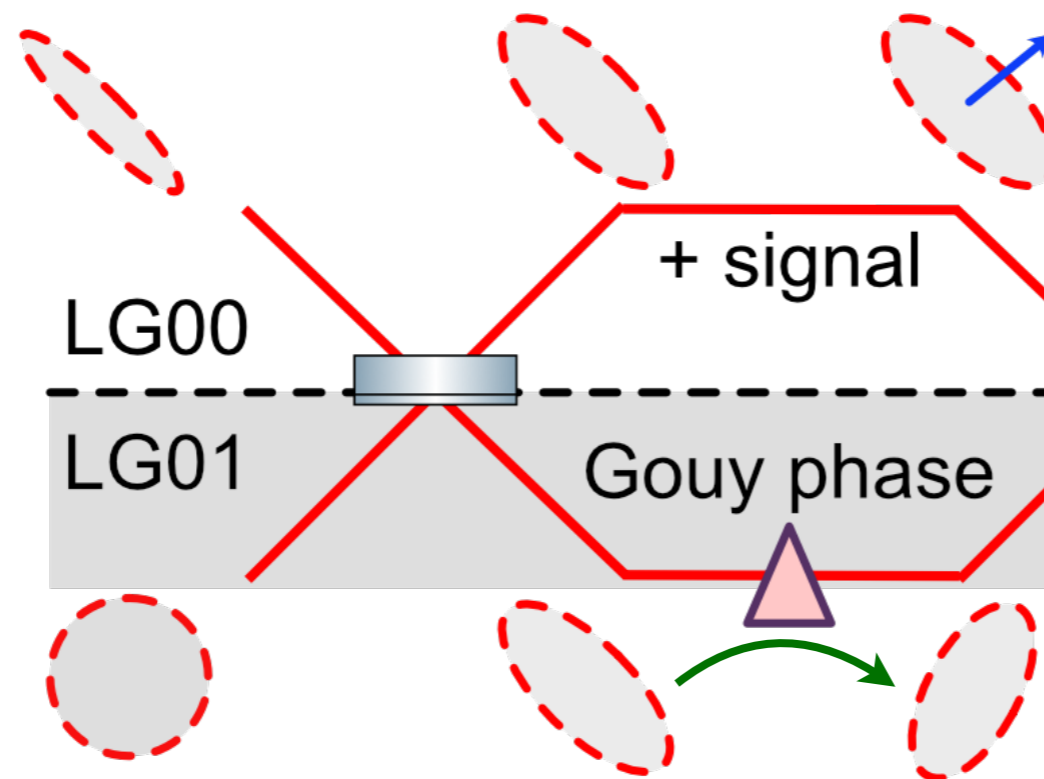
Most important issue: mode mismatch between the squeezed mode and other modes

1. Some part of the squeezed mode is coupled into higher-order mode



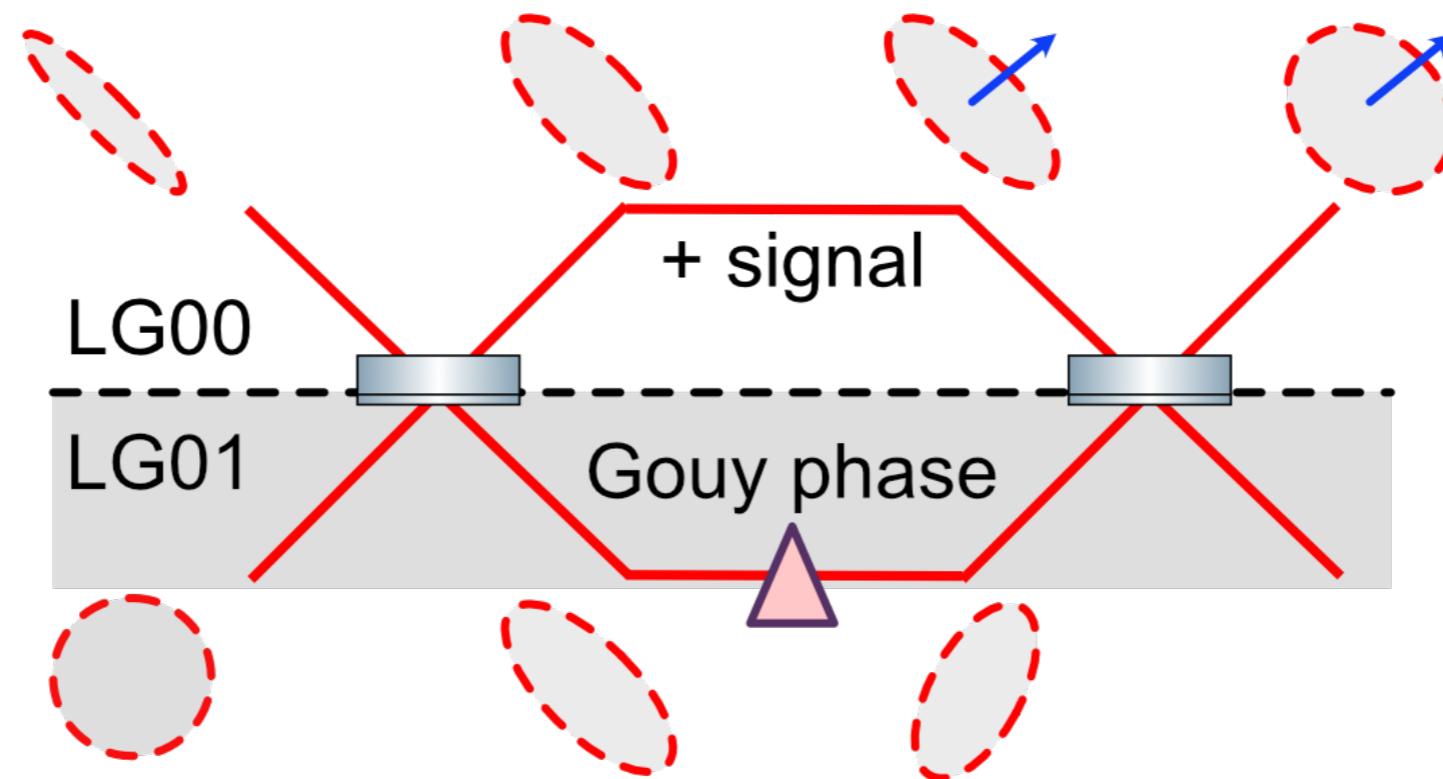
Based on L. McCuller et al. LIGO's quantum response to squeezed states, PRD 104, 062006 (2021)

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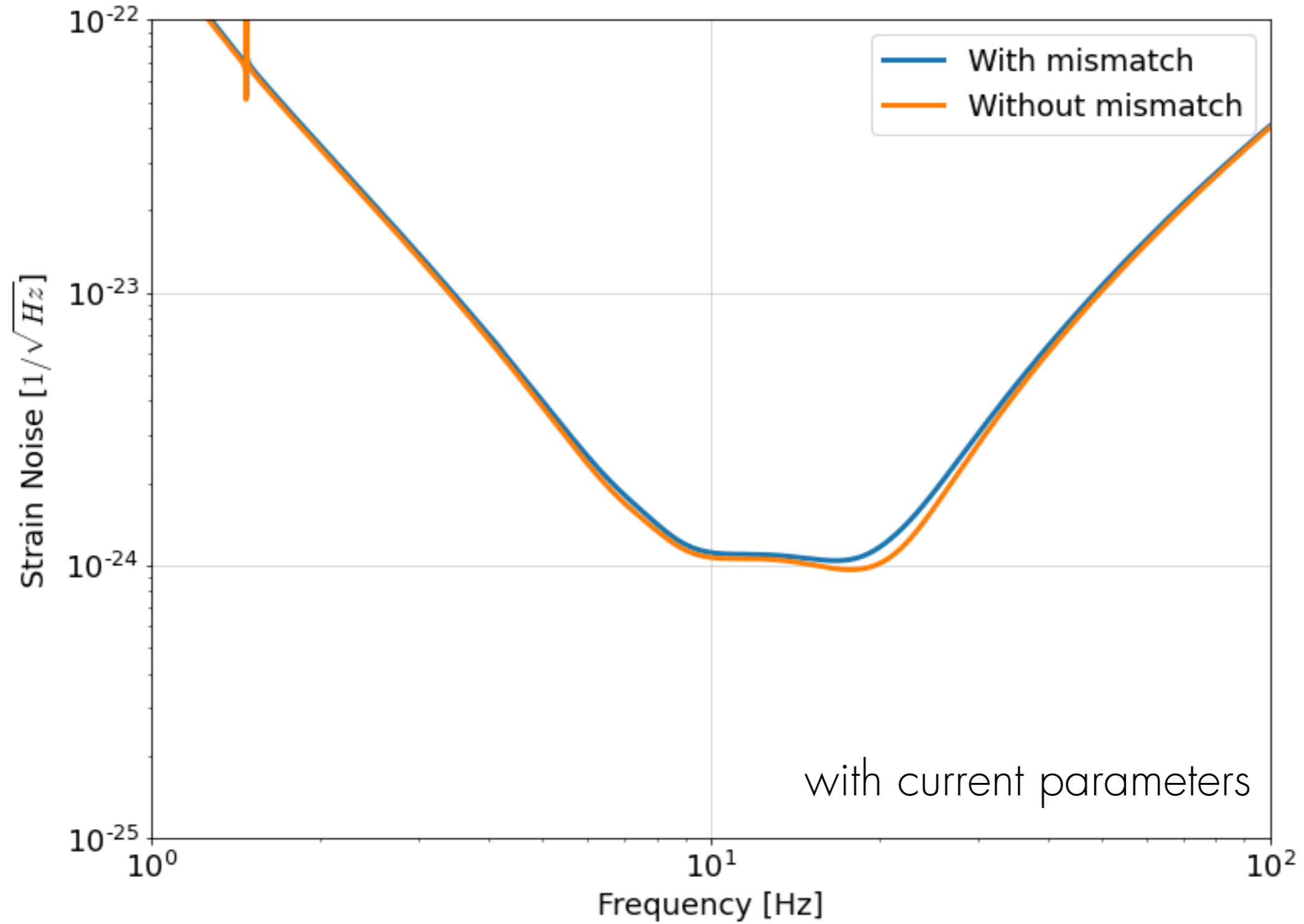


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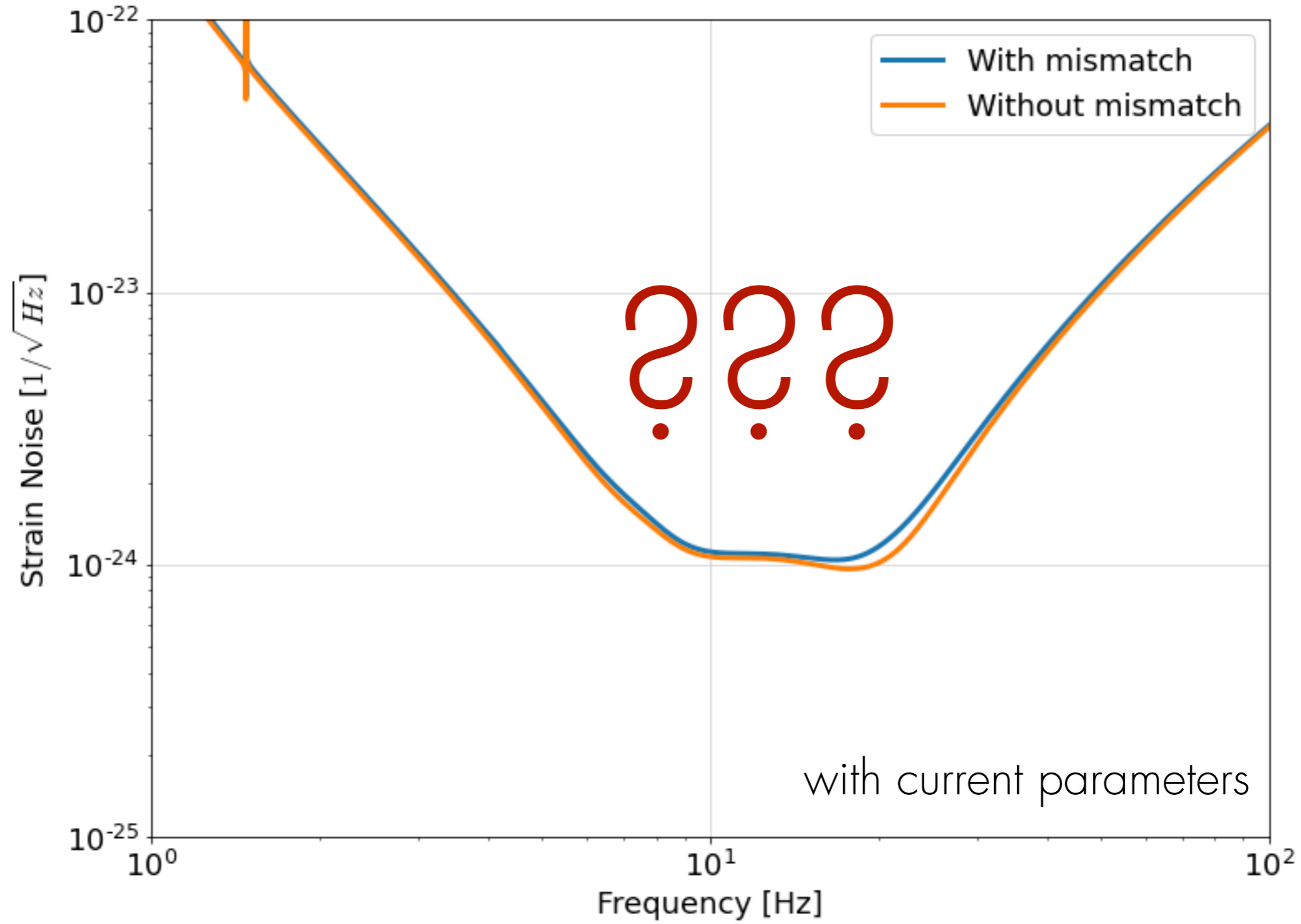
1. Some part of the squeezed mode is coupled into higher-order mode
2. Two mode experience different evolution (different Gouy phase for them)
3. Another mismatch mixes them back with some rotation, coupling two quadratures: *the effective loss is higher than the amplitude of mismatches!*



Is that even a problem?

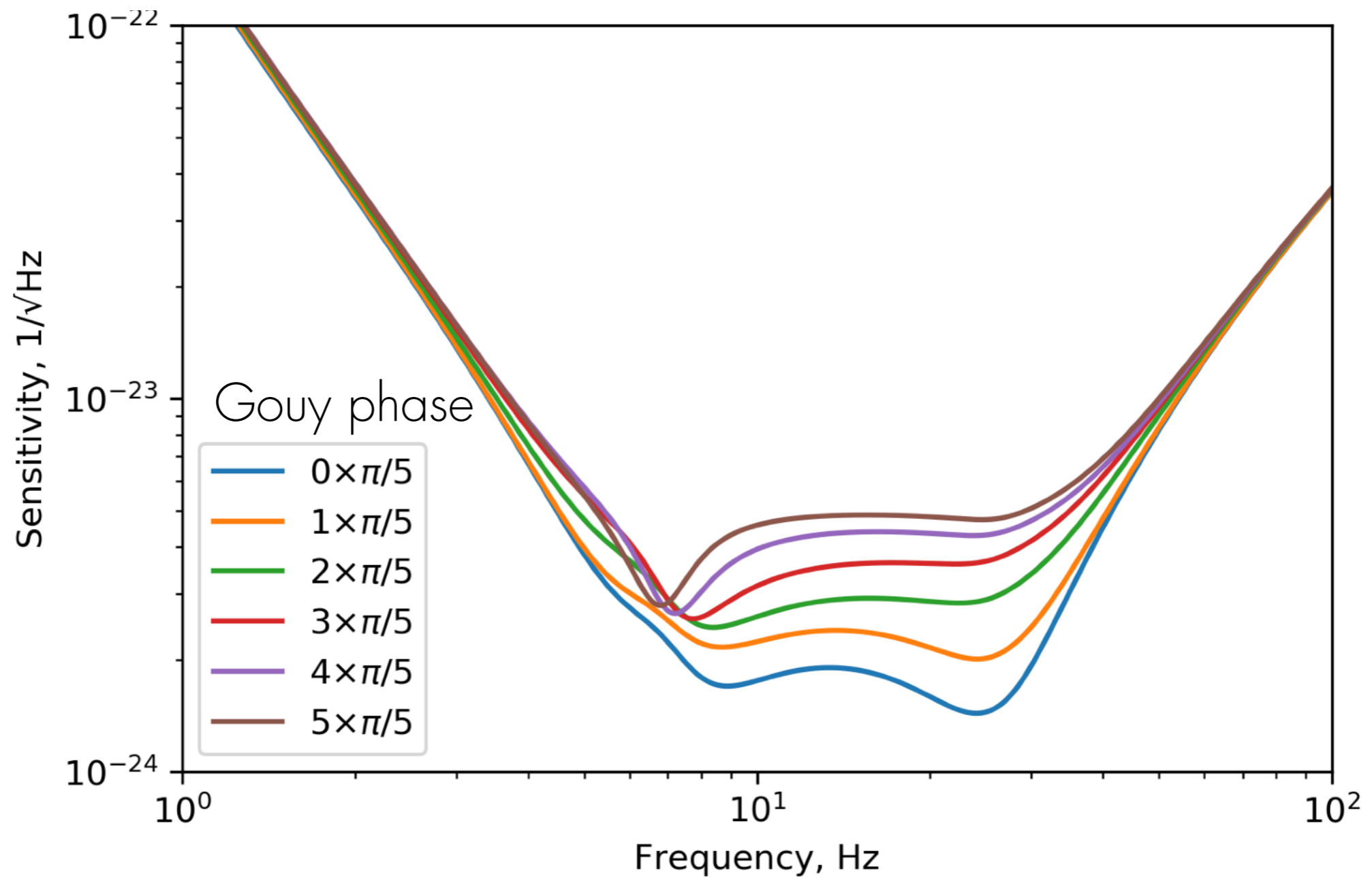


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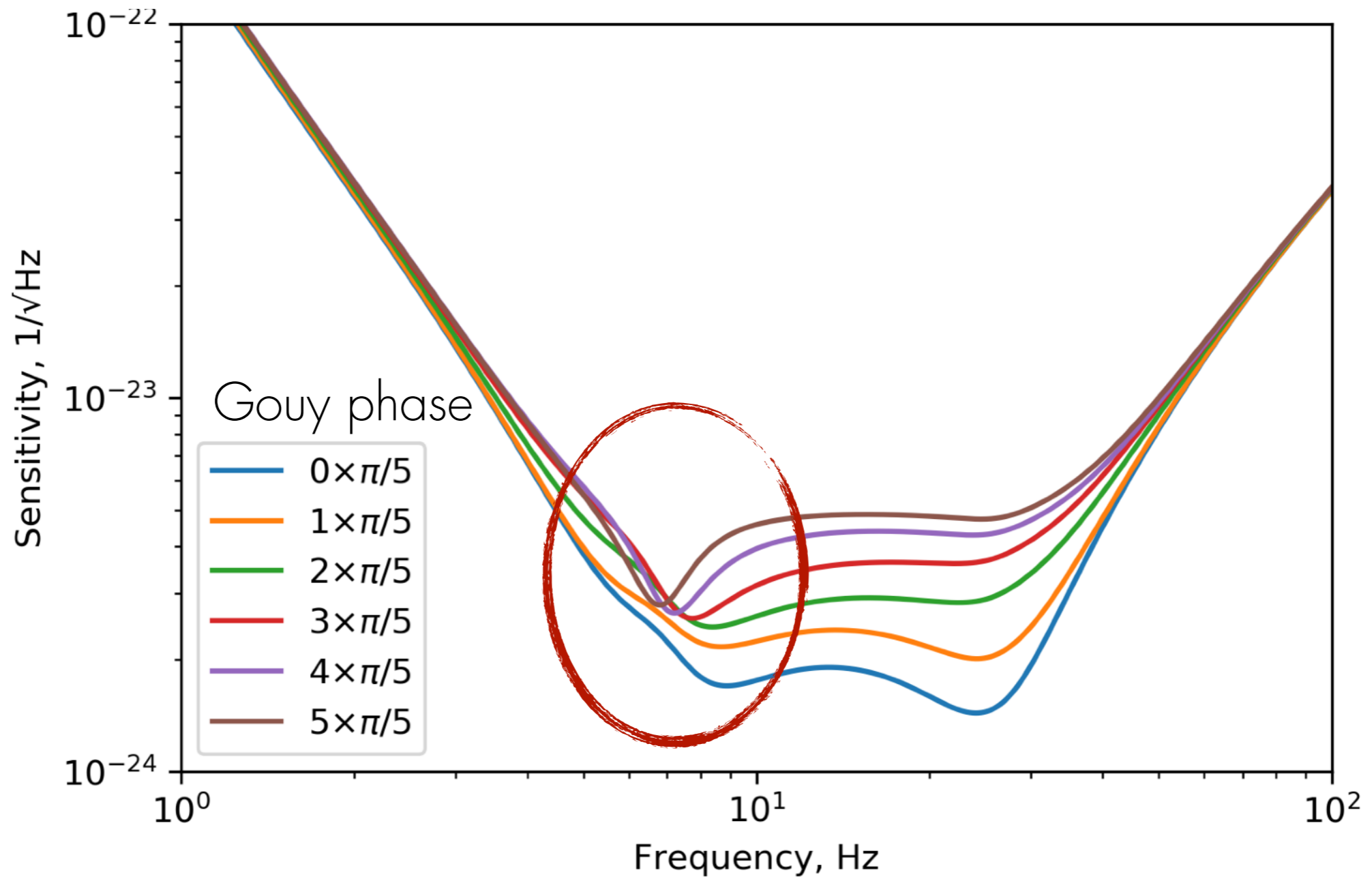
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Introduce 20% mismatch between OPA & OMC and ARM & SRC



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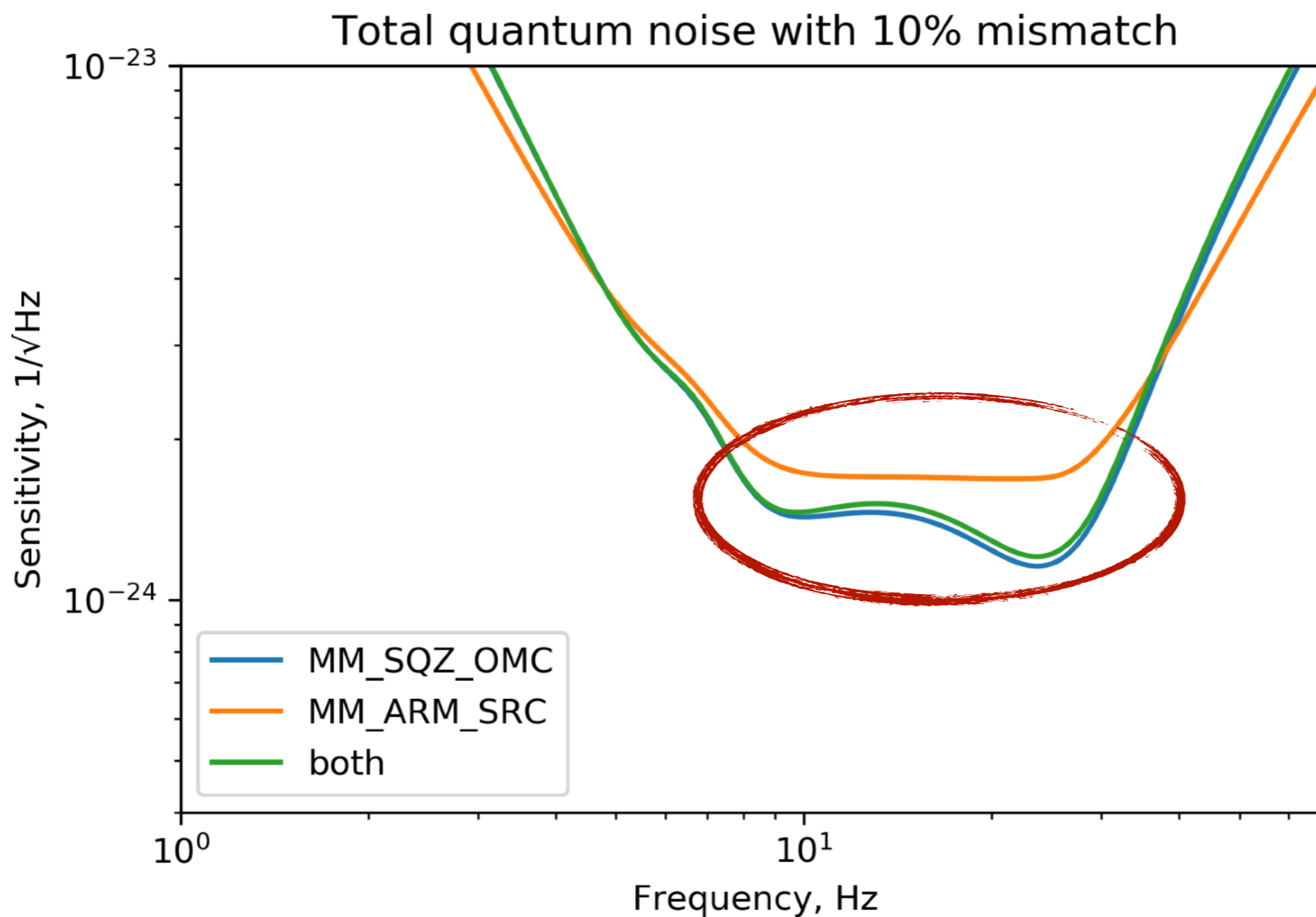


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2. Can we consider only 2 modes?

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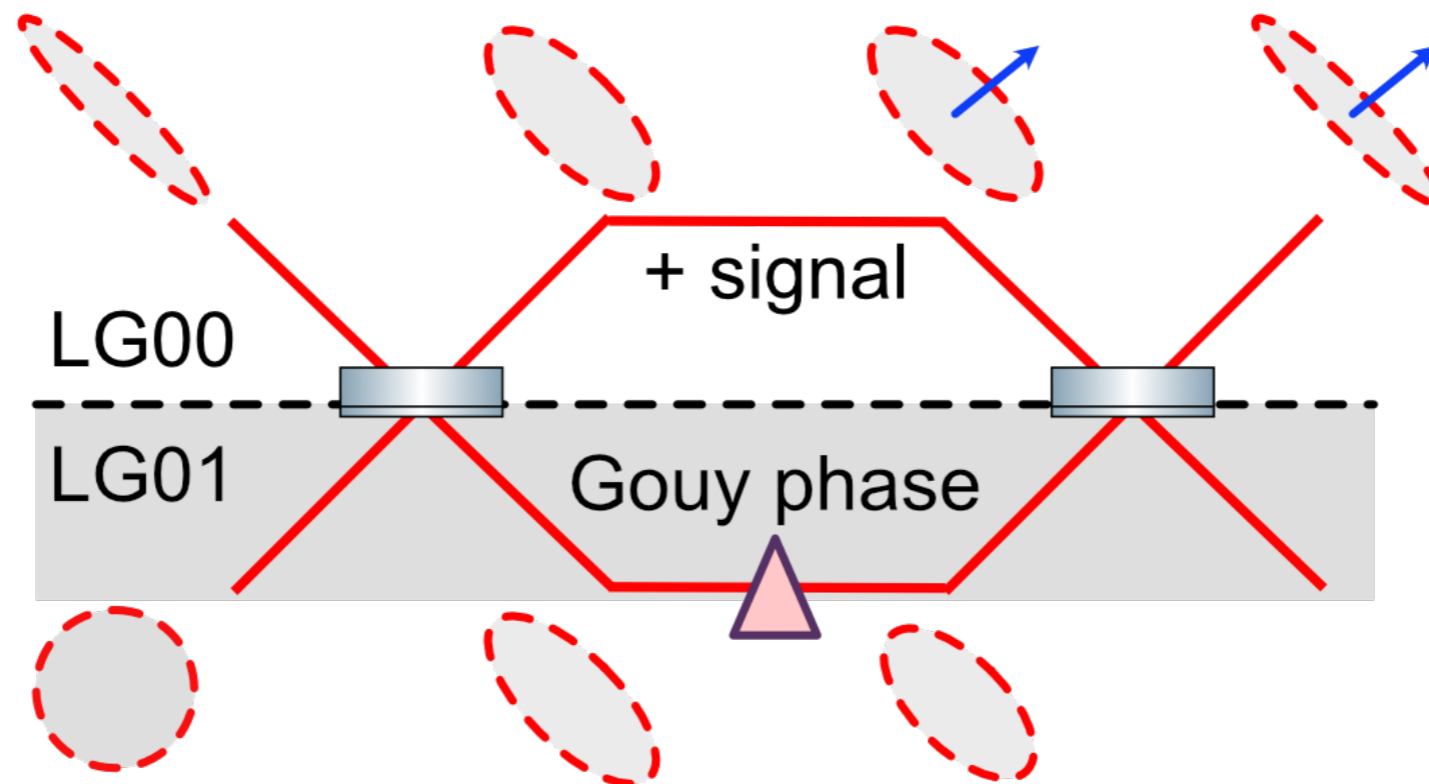
The model is coherent, so coherent cancellation is possible



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In reality we have many modes, and this model is not complete!



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Which mode is the reference? How do the modes couple?

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4. Do we need to account for dynamical contributions to MM-degradation?

Path forward:

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- ▶ We make a simple analytical model
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We need people and your input!

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