Physical Spectra and New Physics

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- No QED: Ws and Zs are degenerate
- Couplings g, v, λ and some numbers f^{abc} and t^{ij}_a

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- Global SU(2) Higgs custodial (flavor) symmetry
  - Acts as right-transformation on the Higgs field only

$$W^a_\mu \to W^a_\mu \qquad h_i \to h_i + a^{ij} h_j + b^{ij} h_j^*$$

Physical states

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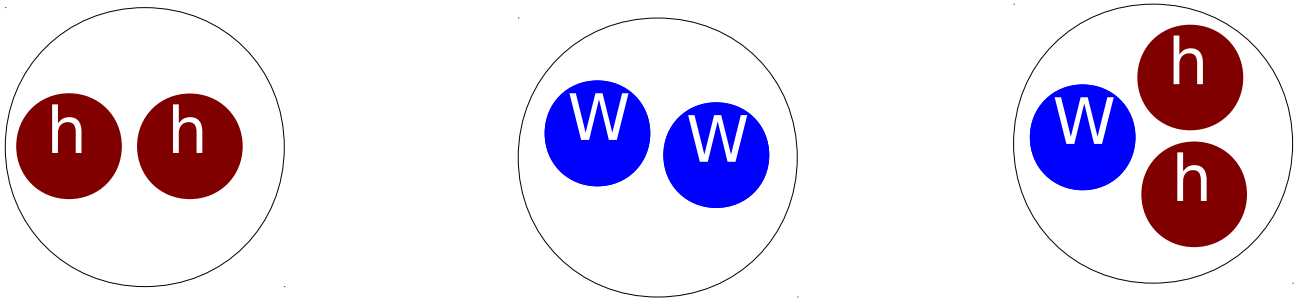
  - Higgs-Higgs, W-W, Higgs-Higgs-W etc.



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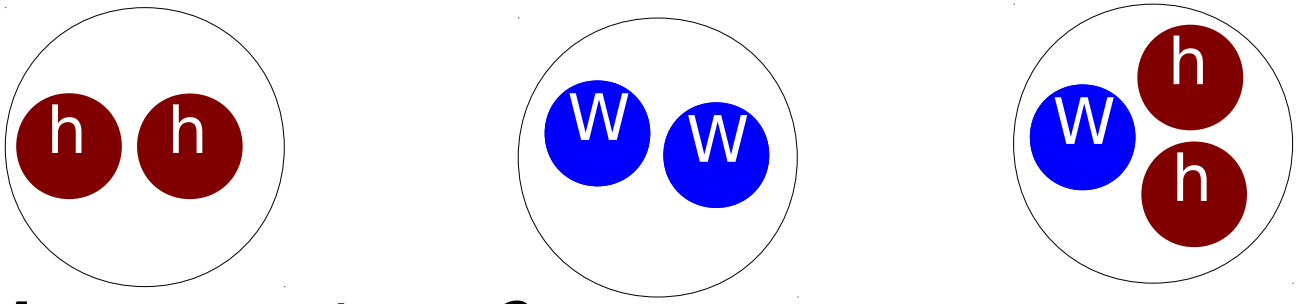

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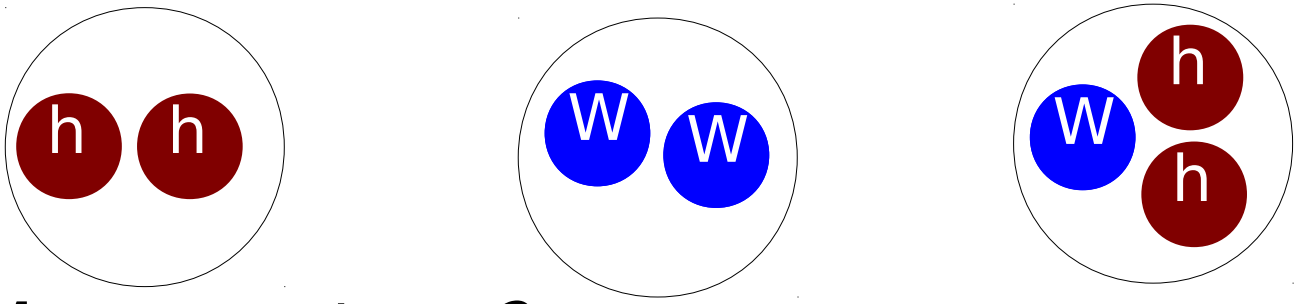

  - Mass spectrum?
  - Why does perturbation theory work?

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- Deeply-bound relativistic state
  - Mass defect~constituent mass
  - Cannot be described with quantum mechanics

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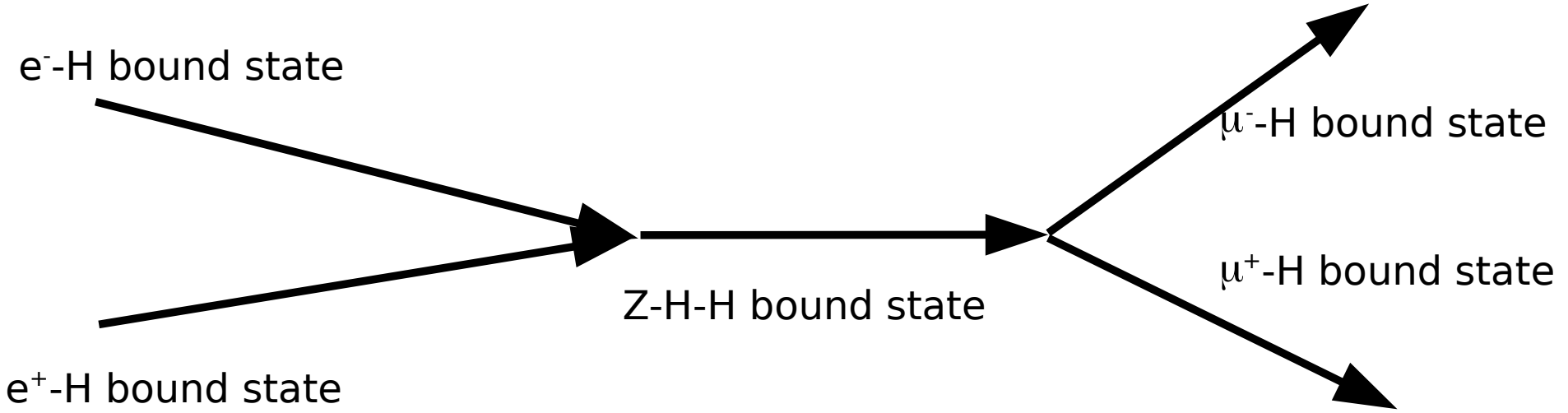
- Photons
  - QED similar but simpler

How events looks like (LEP/ILC)

[Maas'12]



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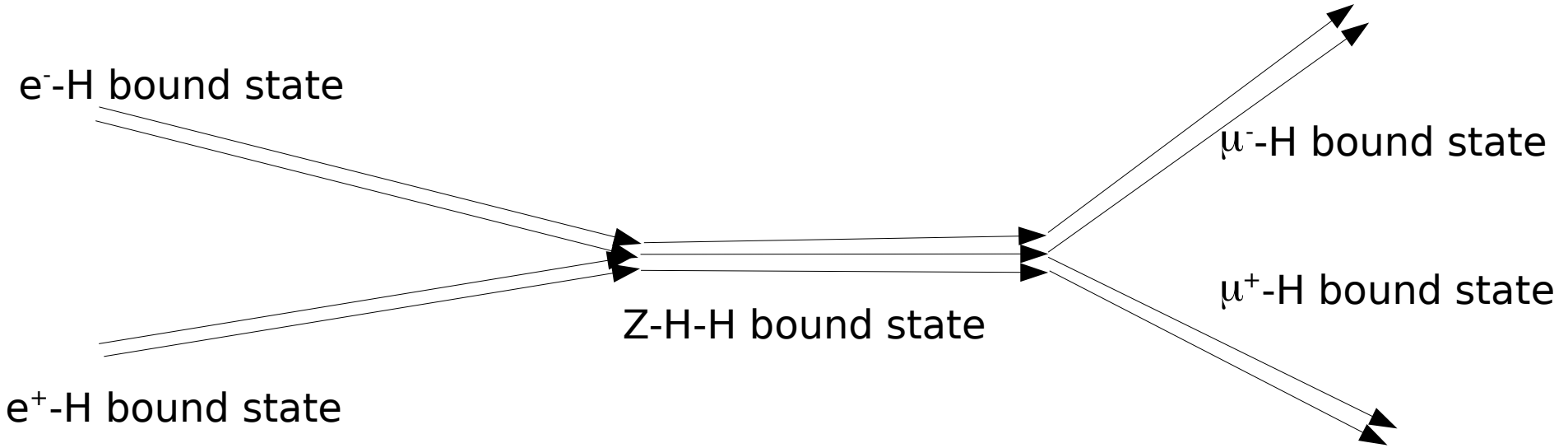

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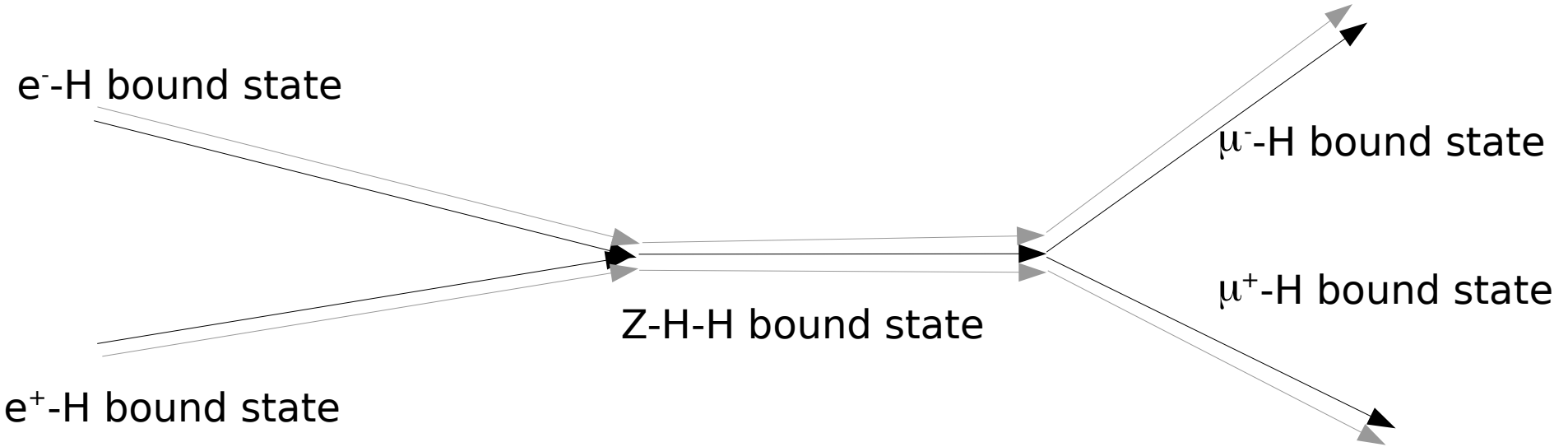

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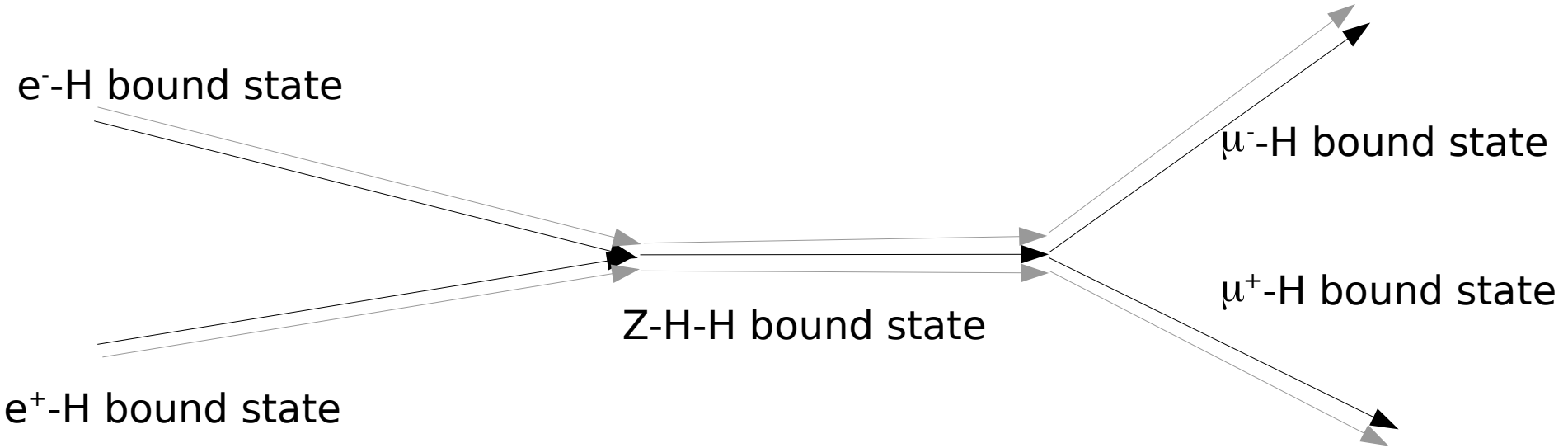

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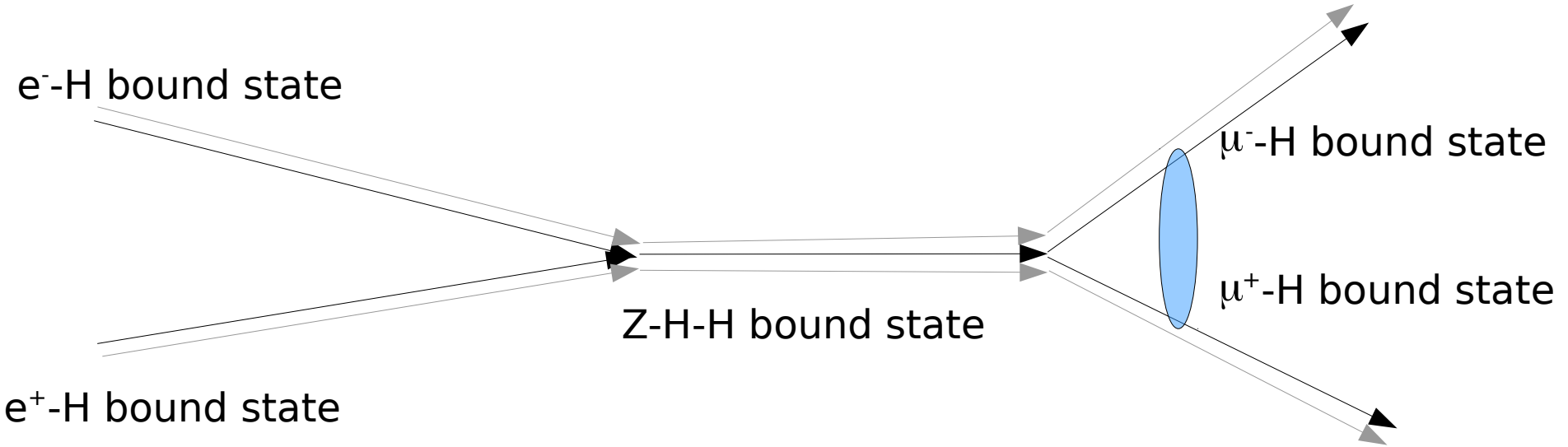

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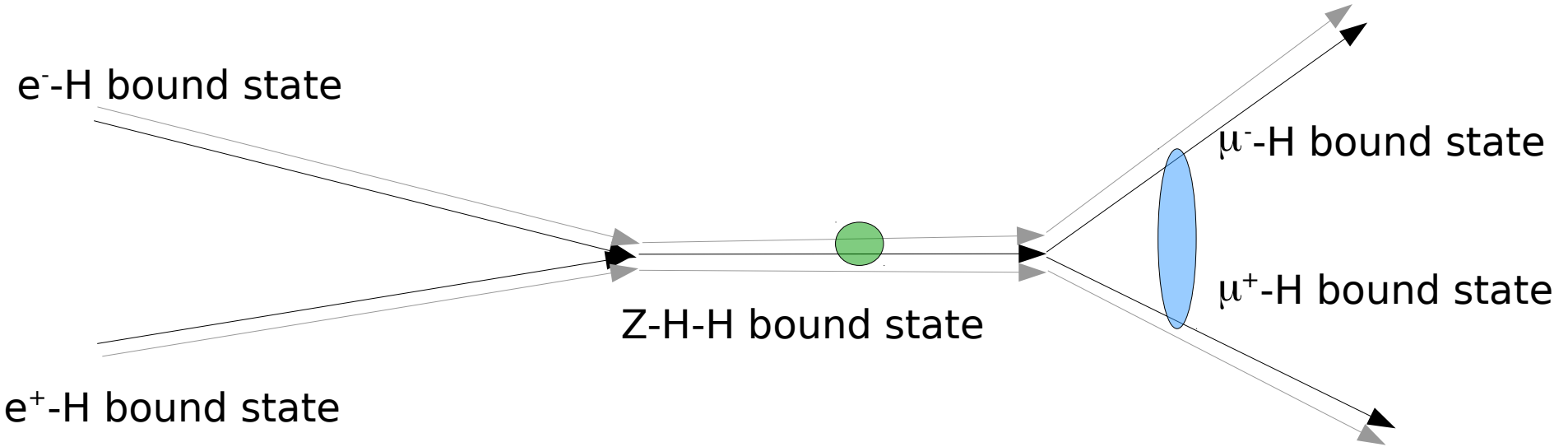

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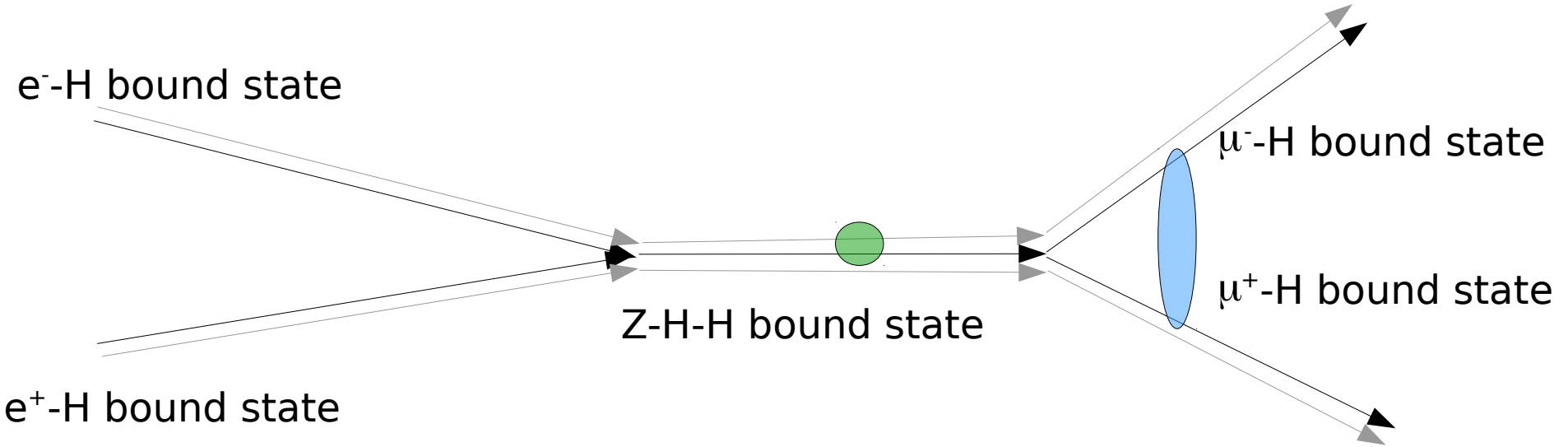

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- 750 GeV: excitation of the 0^+ state? – pure SM!

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- Has to be checked for BSM theories

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[Maas,'15,
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- Size of fluctuations needs to be checked non-perturbatively!

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  - Vectors must be lighter
    - Behavior not yet seen for strong interactions
    - Usually: Scalars and pseudoscalars

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- Can be used to test theories
  - Check for low-mass states
- Theories without BEH effect challenging