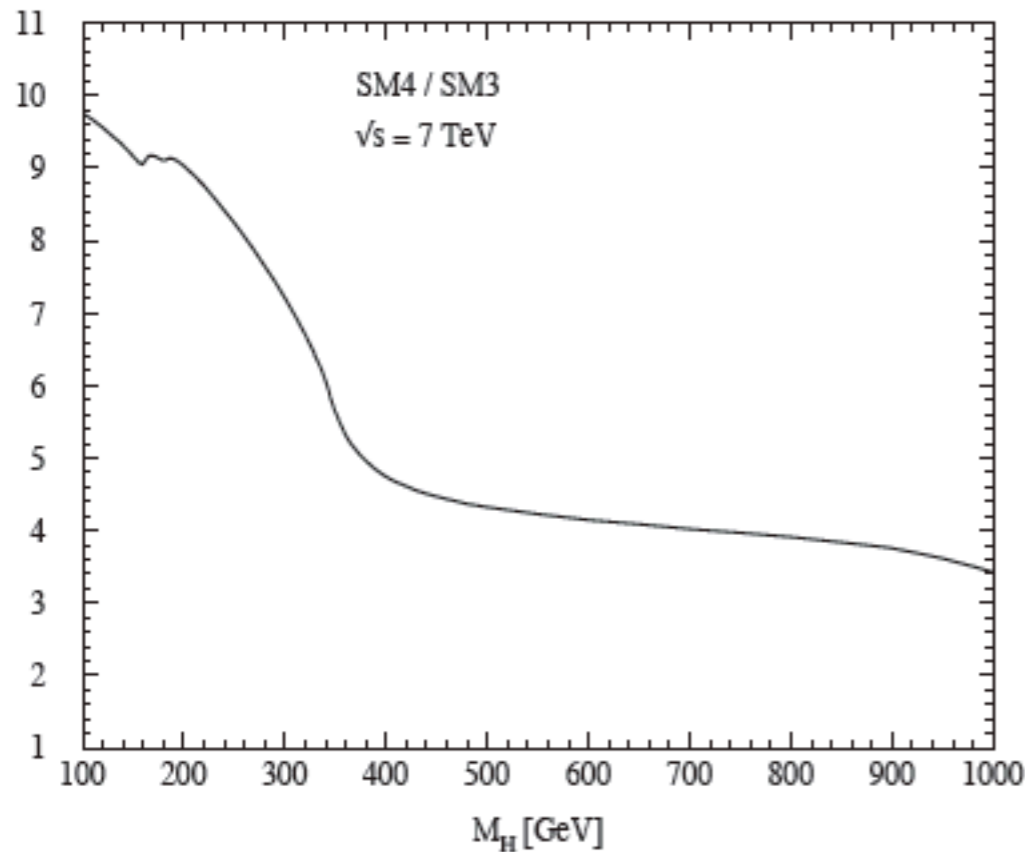


# SM4 Higgs branching ratios (follow-up from yesterday's discussion)

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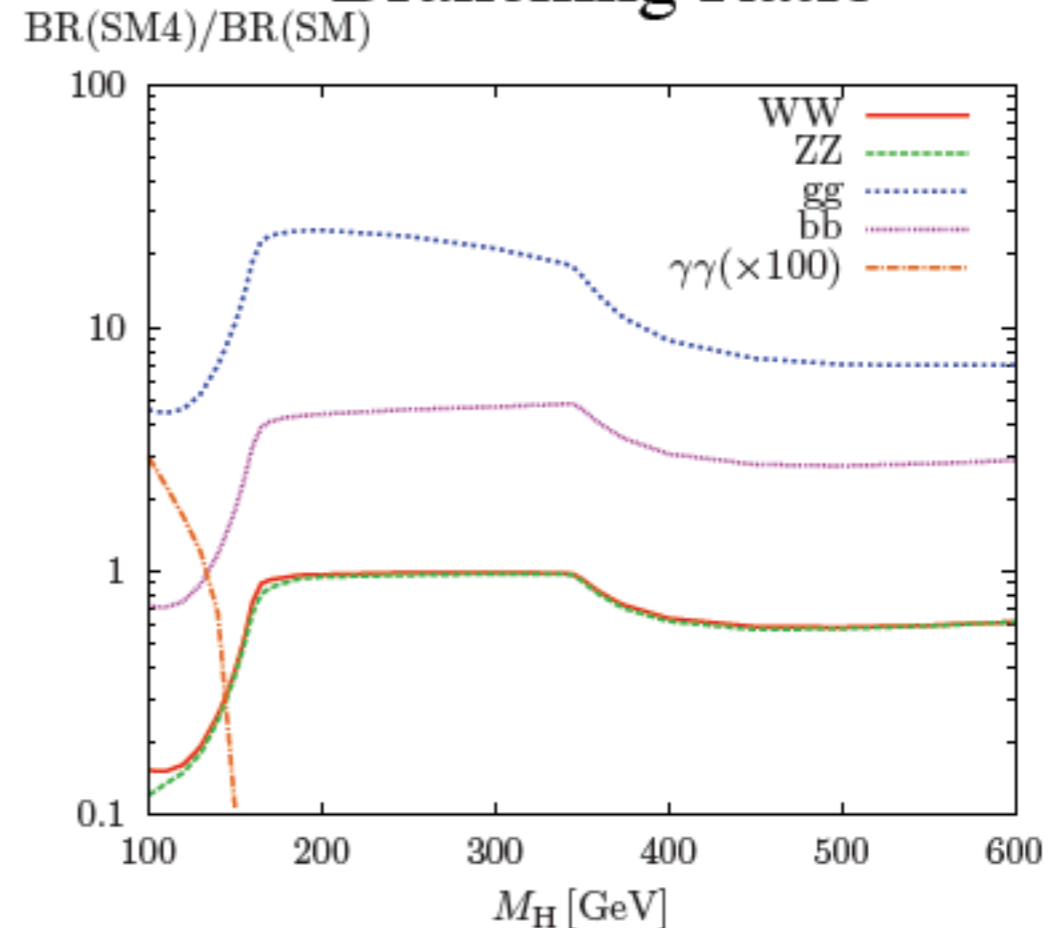
# J. Alwal's talk yesterday:

## Production cross section



Setup: 600 GeV  $b', l', \nu'$

## Branching Ratio



what if  $m_H/2 > m_{\nu_4} > 45 \text{ GeV}$ , enabling  $H \rightarrow \nu_4 \nu_4$

# plots found in:

## Impact of the relatively light fourth family neutrino on the Higgs boson search

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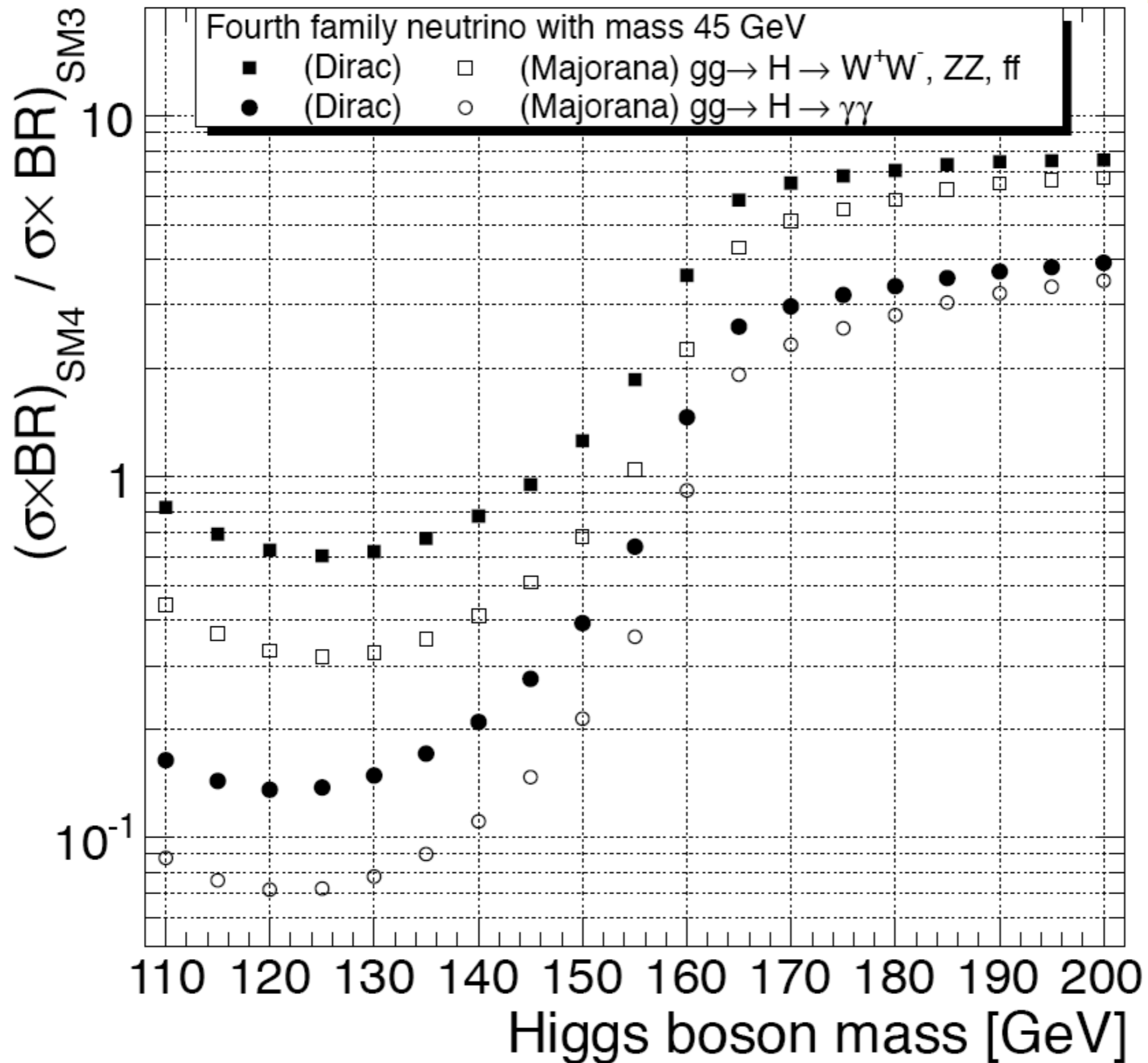
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The existence of a fourth fermion generation has mostly been considered as a source of enhanced Higgs signals with respect to the 3 family Standard Model predictions. However, a fourth Standard Model family neutrino could cause the opposite situation. It is shown that relatively light fourth family neutrino ( $2m_{\nu_4} < m_H$ ) could drastically change the interpretation of the search results for the Higgs boson, especially if  $m_H < 170$  GeV.

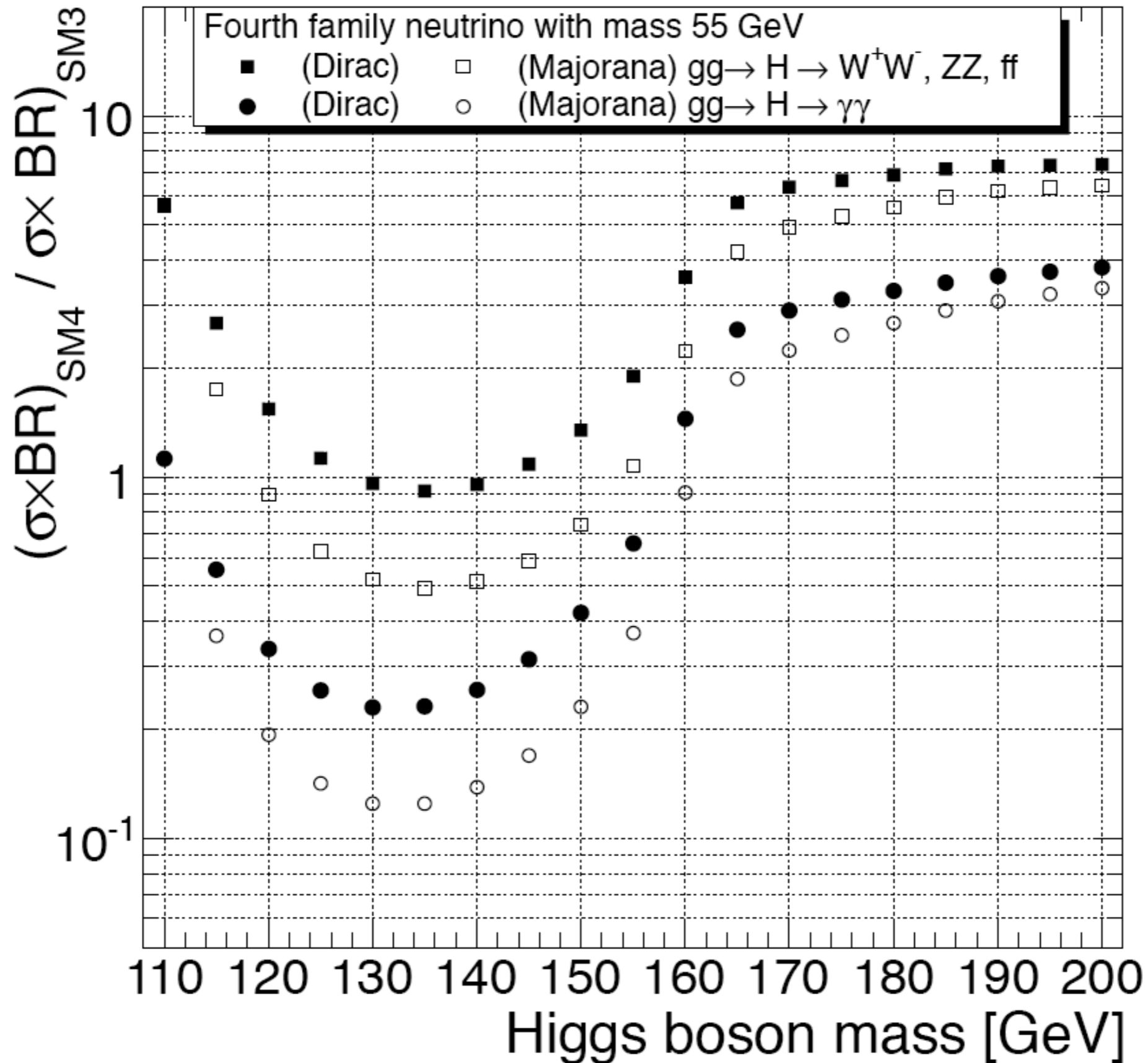
Discovery of the Higgs boson will complete confirmation of the Standard Model (SM) basics. It is well known that the fourth SM family fermions (for the remainder of this text, SM with three and four families will be denoted as SM3 and SM4, respectively.) have strong...

be eliminated as statistical fluctuation by comparing to the results from the other channels. The discrepancies are in  $H \rightarrow WW \rightarrow \ell\nu\ell\nu$  channel in the region  $120 < m_H < 180$  GeV observed by both ATLAS and CMS, and in  $H \rightarrow ZZ \rightarrow \ell\ell q\bar{q}$  channel, in the vicinity

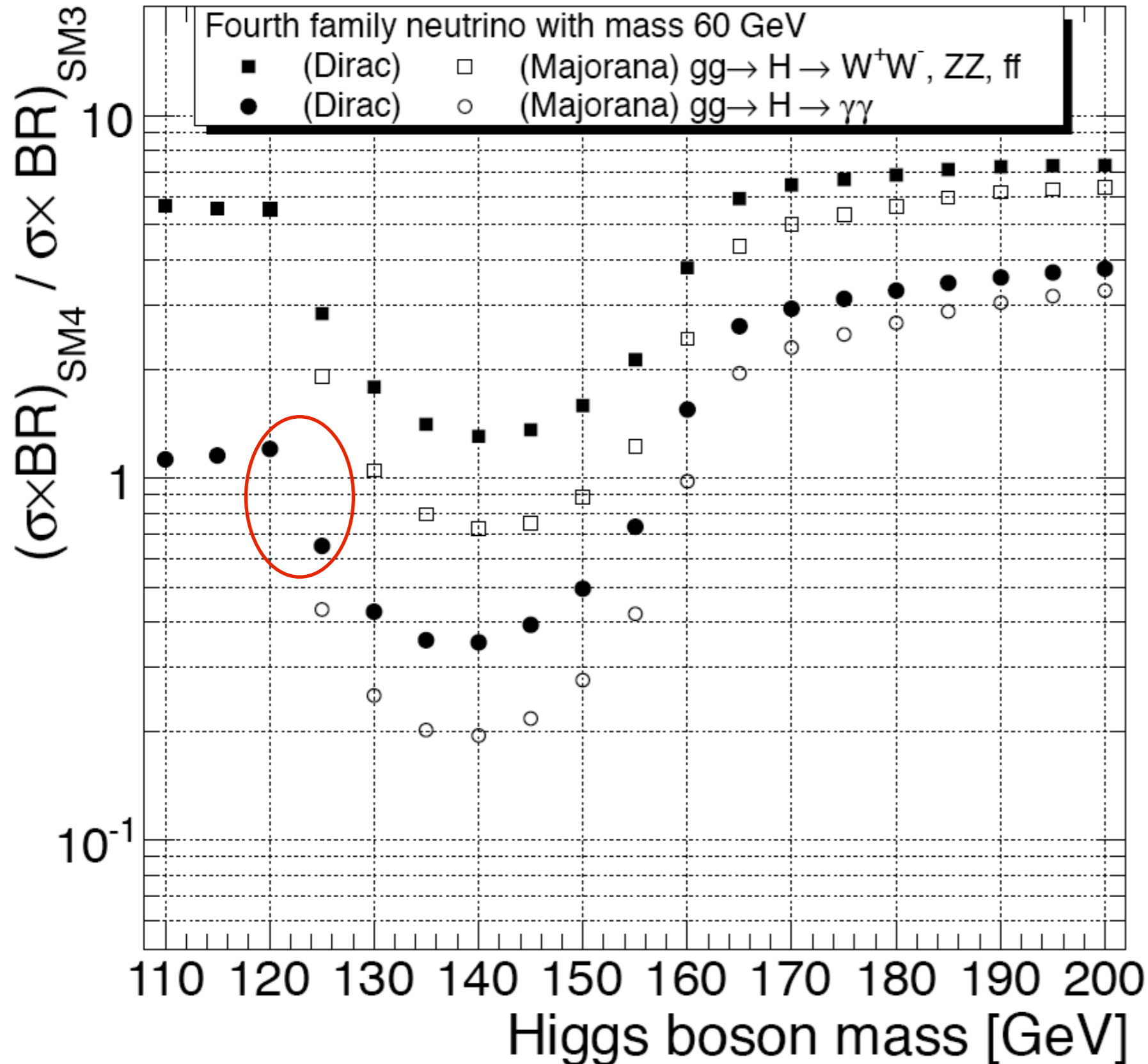
# $m_{\nu_4} = 45 \text{ GeV}$



# $m_{\nu_4} = 55 \text{ GeV}$



# $m_{\nu 4} = 60 \text{ GeV}$



if  $m_H = 122 \text{ GeV}$

then

$$\frac{(\sigma \times BR_{H \rightarrow \gamma\gamma})_{SM4}}{(\sigma \times BR_{H \rightarrow \gamma\gamma})_{SM3}} = 1$$

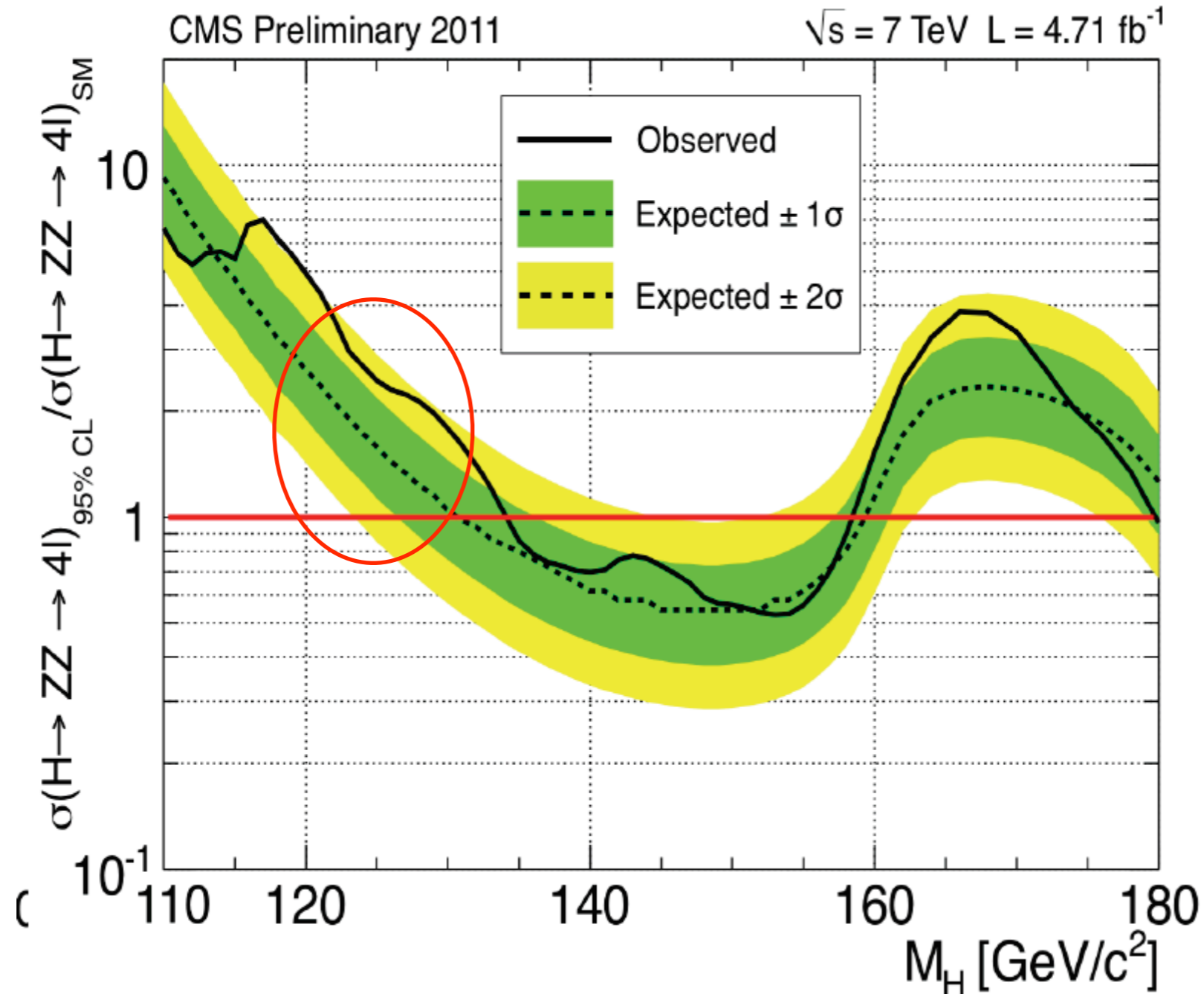
and

$$\frac{(\sigma \times BR_{H \rightarrow ZZ})_{SM4}}{(\sigma \times BR_{H \rightarrow ZZ})_{SM3}} \approx 2.5$$



# consistent with data?

## exclusion of $H \rightarrow ZZ$



# conclusion

need to put everything together:

- add NLO EW corrections (see J. Alwal yesterday)
- current experimental limits (excesses)
- is  $m_H = 122-125\text{GeV}$  still consistent with SM4?