When LHC/TEVATRON combine with XENON to restrict portal like models

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Y.M. 1108.0671; JCAP ---- (2011)
Y.M., B. Zaldivar 1106.4819; JCAP 1110 (2011) 037
Y.M. 1104.4799; JCAP 1107 (2011) 009
Y.M. 1012.0447; PoS (2010) 027
Y.M. 1006.3318; JCAP 1009 (2010) 022
Y.M. 0907.2918; JCAP 0912 (2009) 005

GDR Terascale 2011, 12th of October 2011

Outline

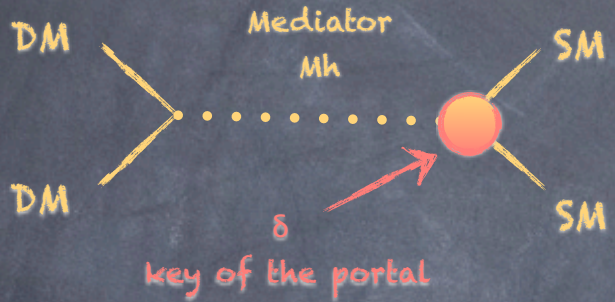
- Z' portal : Direct detection excess, combined analysis
- Higgs Portal : Direct detection, combined analysis
- Invisible Higgs decay and LHC/TEVATRON analysis
- Perspective and Conclusion

Extensions of the SM

- Extension of the content of the SM : V_R, SUSY
- Extension of the Gauge group, new «force» : extra U(1), SO(32)
- Extension of the space-time structure : supergravity, KK, strings

Constraints in «portal like» models

WMAP : $\sigma v \sim 10\text{-}26\ cm3\ s\text{-}1$



$\sigma_{DM\text{-}SM} \sim 10\text{-}36\ cm2$

=> excess in DD exp.

Except around the pole : $2M_{DM} = Mh$: small δ to respect WMAP

=> small $\sigma_{DM\text{-}SM}$

In this case, high indirect detection rates !!

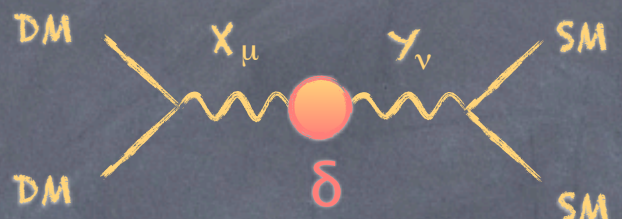
M. Cicoli, M. Goodsell,
J. Jaeckel, A. Ringwald
2011

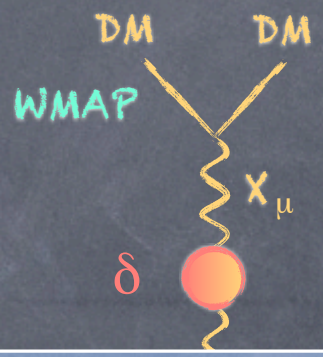
Gauge extension: Extra $U_D(1)$

YM 2010, YM 2011

$SU(3)*SU(2)*U(1)*U_D(1)$

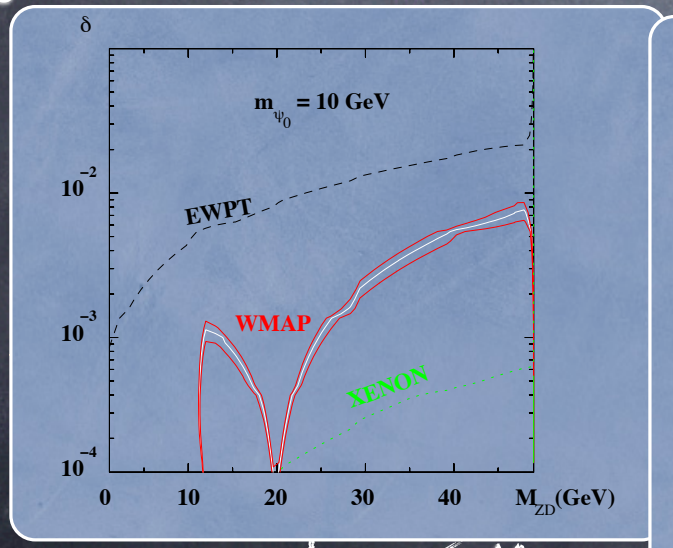
$g_\mu \quad W_\mu \quad Y_\mu \quad X_\mu$





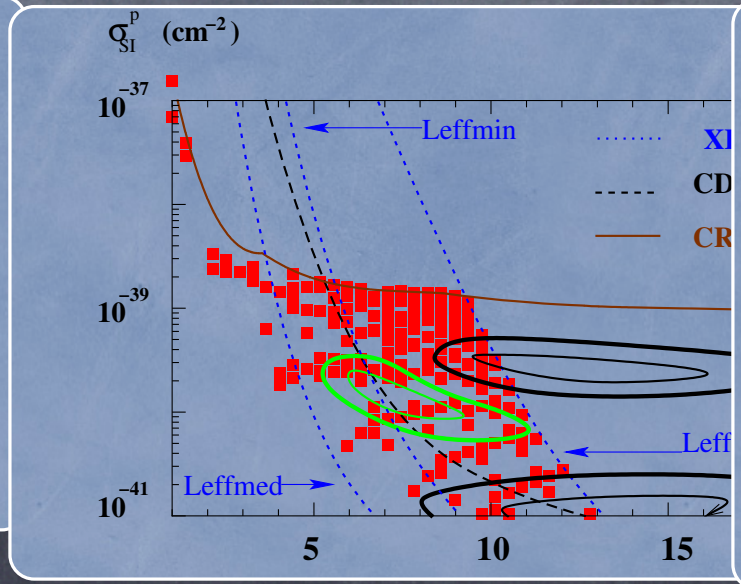
$$\mathcal{L}' = -1/4\ F^{Y}_{\mu\nu} F^{Y\mu\nu} \quad -1/4\ F^{X}_{\mu\nu} F^{X\mu\nu} \quad + \delta/2\ F^{Y}_{\mu\nu} F^{X\mu\nu}$$

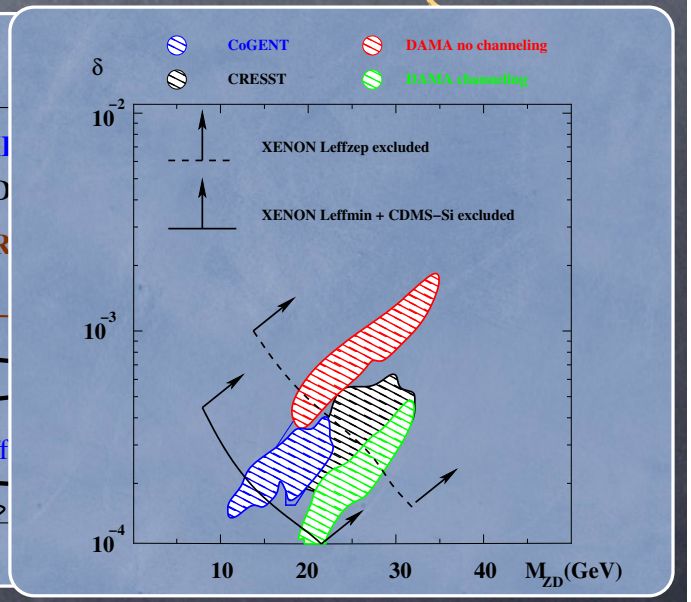
δ



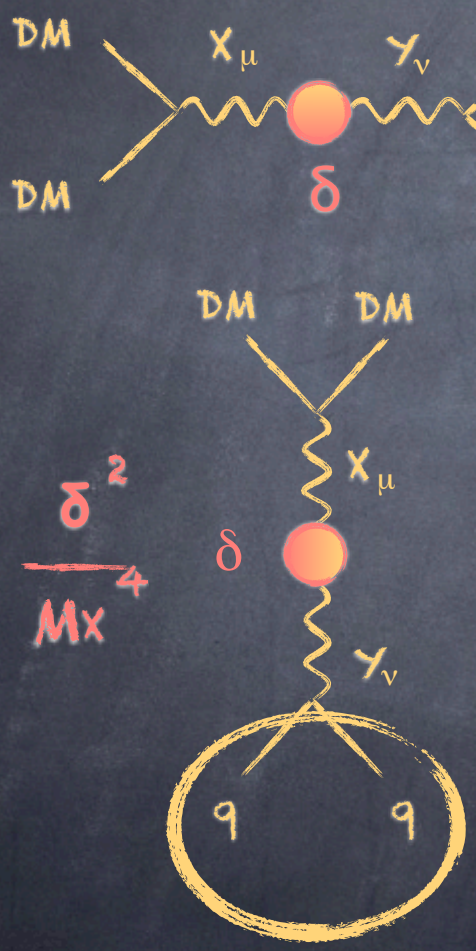
M_{DM} = 10 GeV

Mx



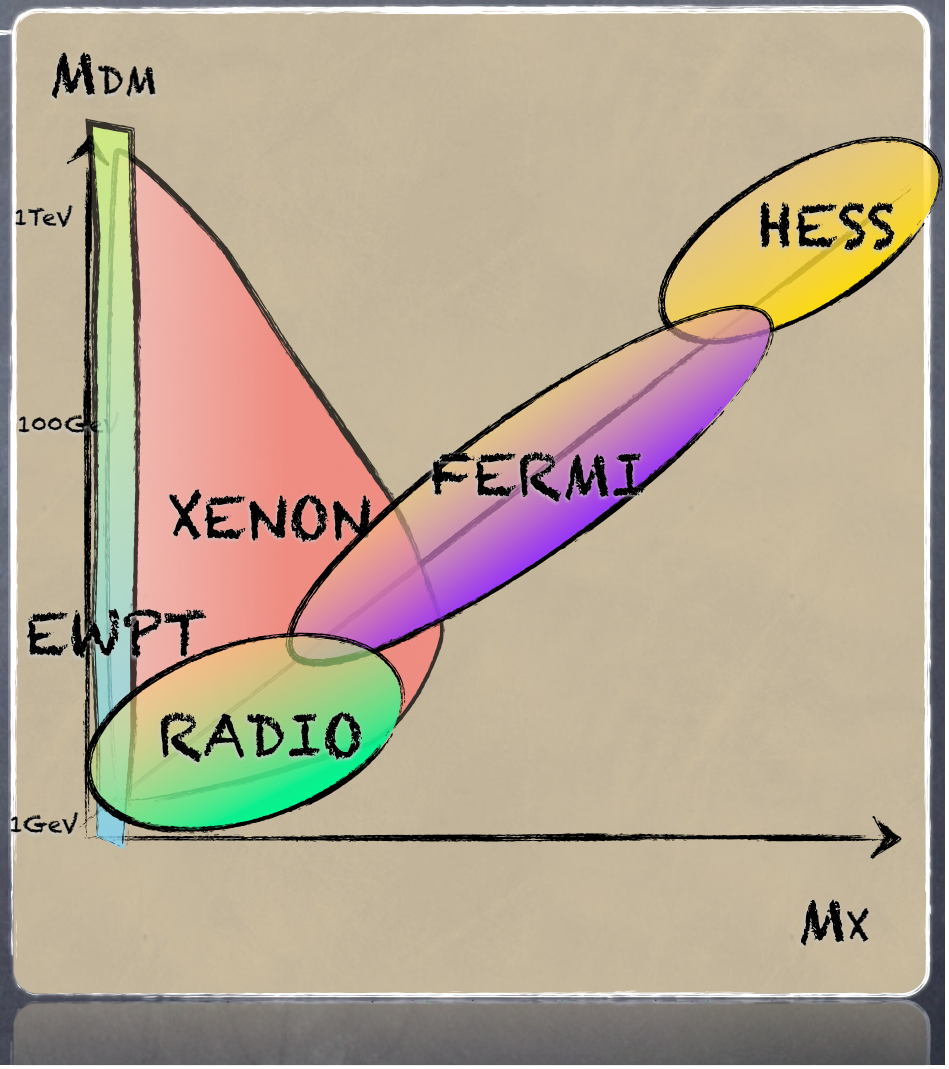


Overview



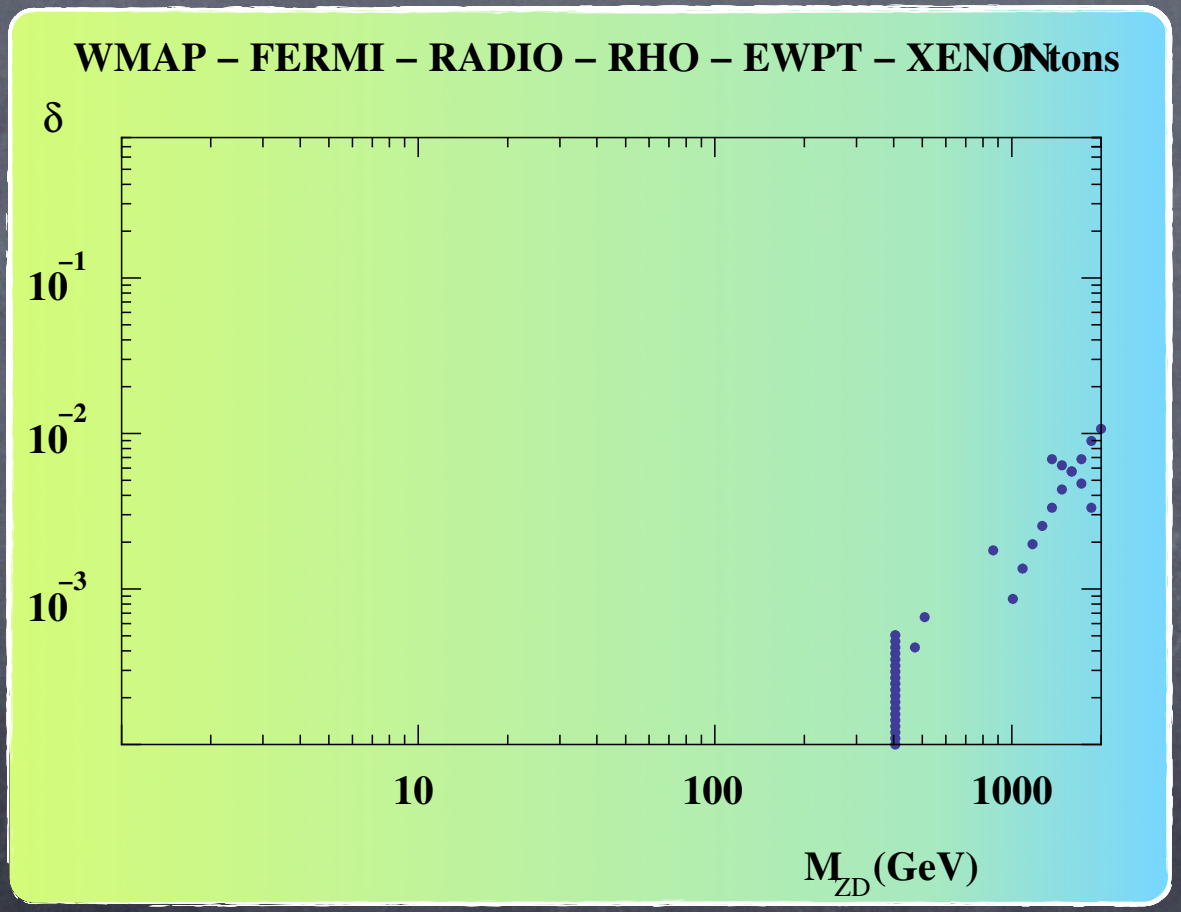
$$\frac{\delta^2}{(M_X^2 - 4M_{DM}^2)^2}$$

$$\frac{\delta^2}{M_X^4}$$



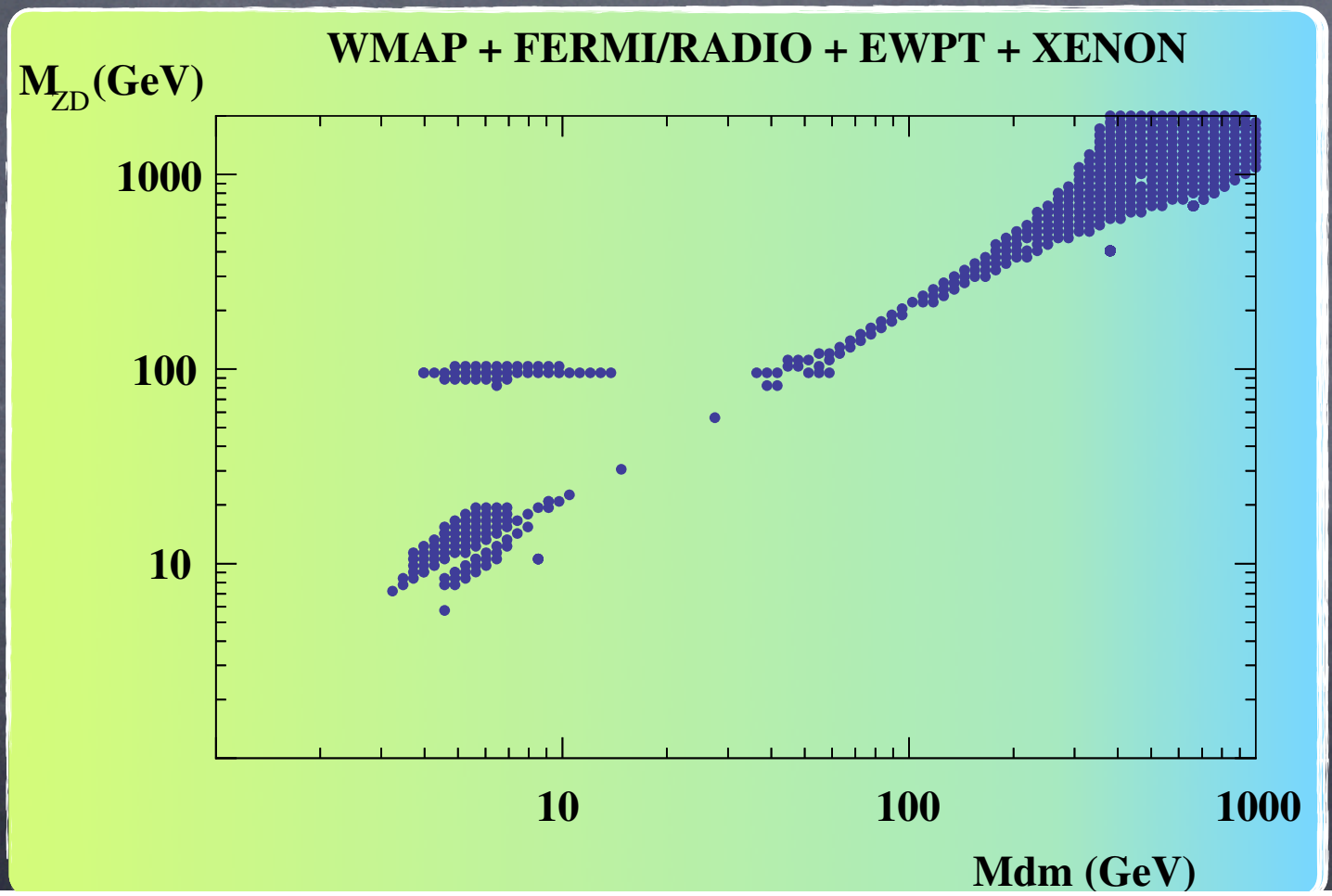
Constraints on (M_{ZD}; δ)

YM 2011



Constraints on (M_{DM}; M_{ZD})

YM 2011



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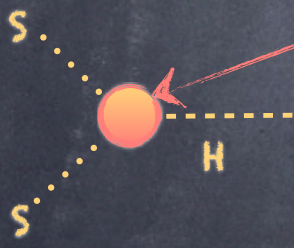
2011

Singlet Extension of the SM

To build the simplest gauge invariant extension of the SM

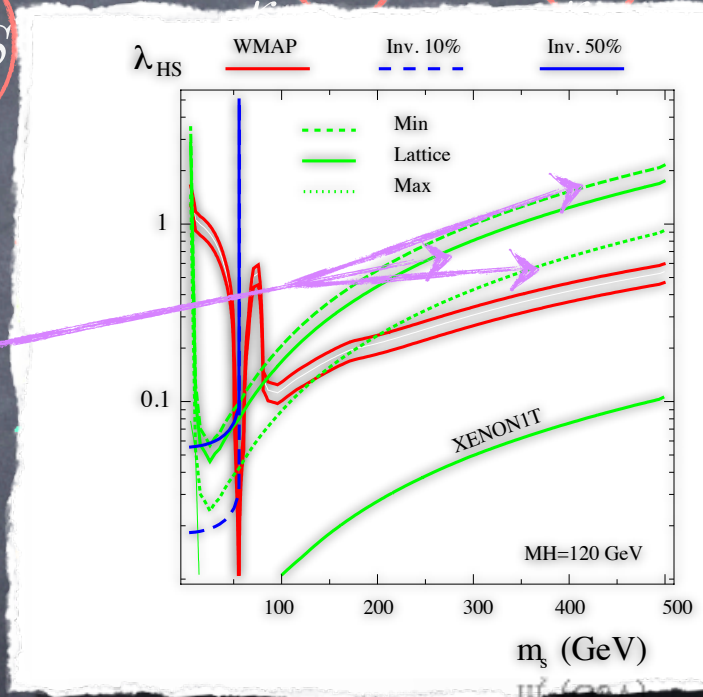
$$\mathcal{L} = \mathcal{L}_{SM} + \frac{1}{2}\partial_\mu S \partial^\mu S - \frac{\lambda_S}{4} S^4 - \frac{\mu_S^2}{2} S^2 - \frac{\lambda_{HS}}{4} S$$

No phenomenology (<S>=0)



$$\sigma^{SI}_{S-p} = \frac{m_p^4 \lambda_{HS}^2 (\sum_q f_q)^2}{16\pi (m_p + m_S)^2 M_H^4}$$

$$\langle \sigma_{f\bar{f}} v \rangle = \frac{\lambda_{HS}^2 (m_S^2 - m_f^2)^{3/2} m_f^2}{16\pi m_S^3 [(4m_s^2 - M_H^2)^2 + M_H^2 \Gamma_H^2]}$$



Invisible width of the Higgs

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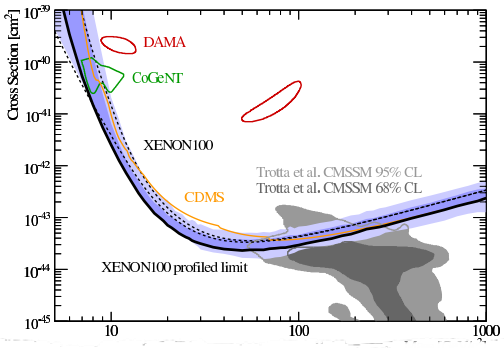
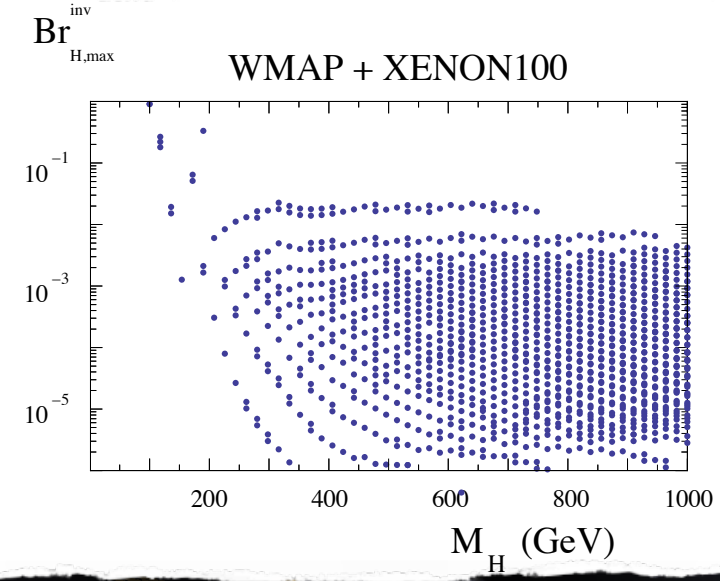
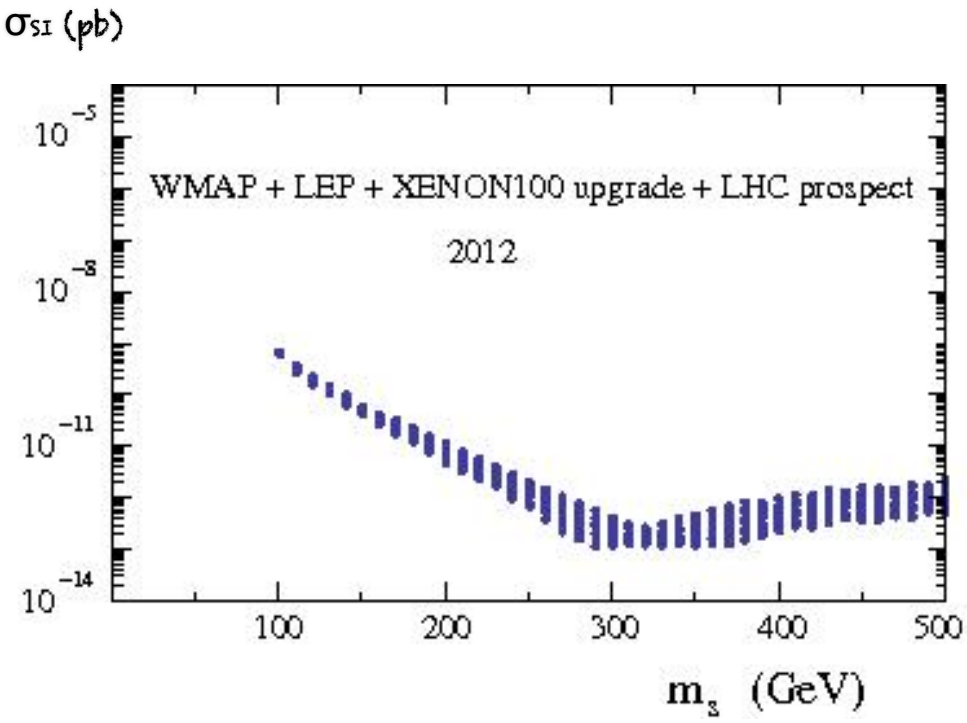
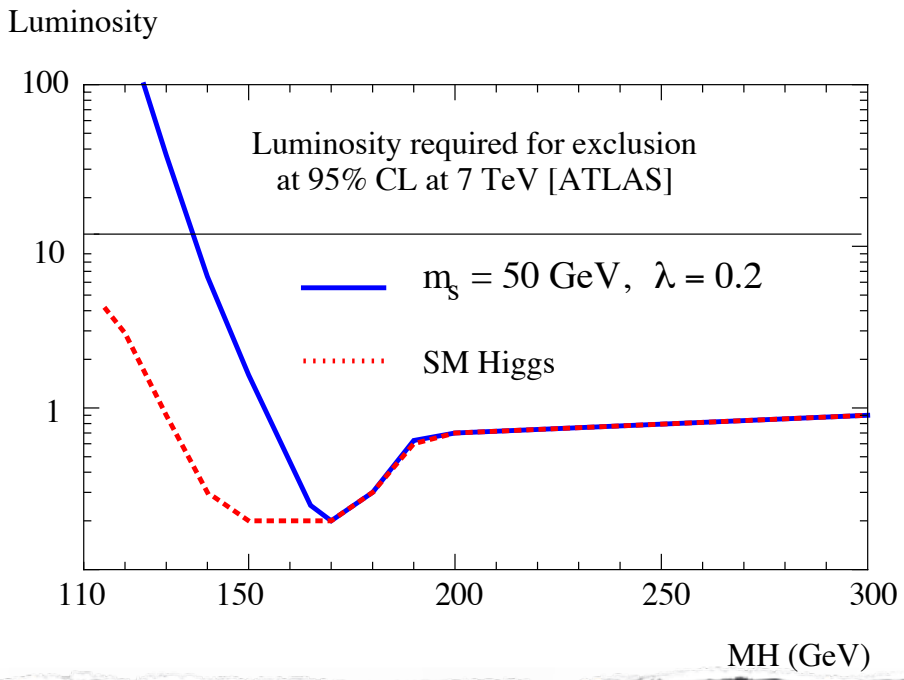
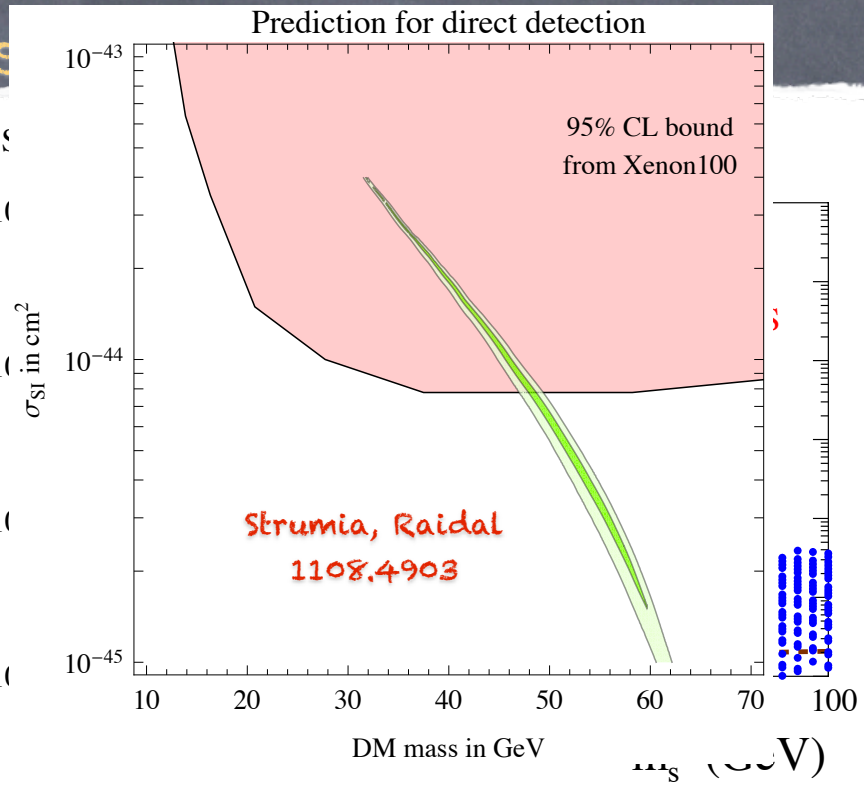






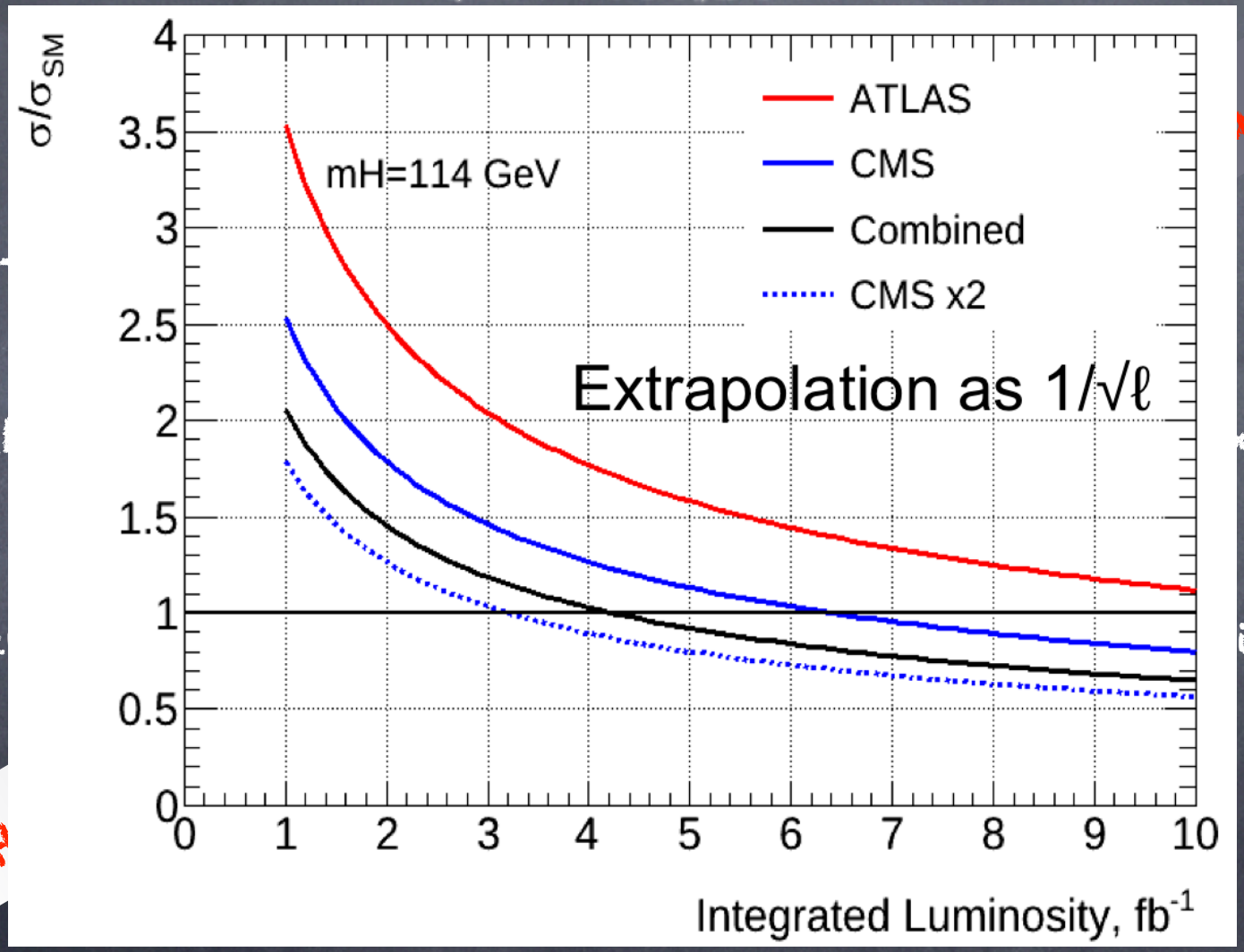
And if LHC sees nothing?





Conclusion

- Protla
- Several
- Comple
- Can



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