The 15th International Conference on Supersymmetry and the Unification of Fundamental Interactions
Karlsruhe, Germany
July 26 - August 1, 2007

~~Résumé~~ de SUSY07

Morceaux choisis de SUSY07

+ quelques updates choisis aussi ☺

- ~ 550 participants (LLR 1995 : ~100)
- site historique pour la susy (Wess† et Zumino)
- semaine précédente : école preSUSY
- Sessions plénières le matin, sessions parallèles l'après-midi :
  - Colliders - Higgs Phenomenology
  - Colliders - SUSY Phenomenology
  - Cosmology
  - Flavor
  - Theoretical Models
  - Alternatives

http://www.susy07.uni-karlsruhe.de/

plan

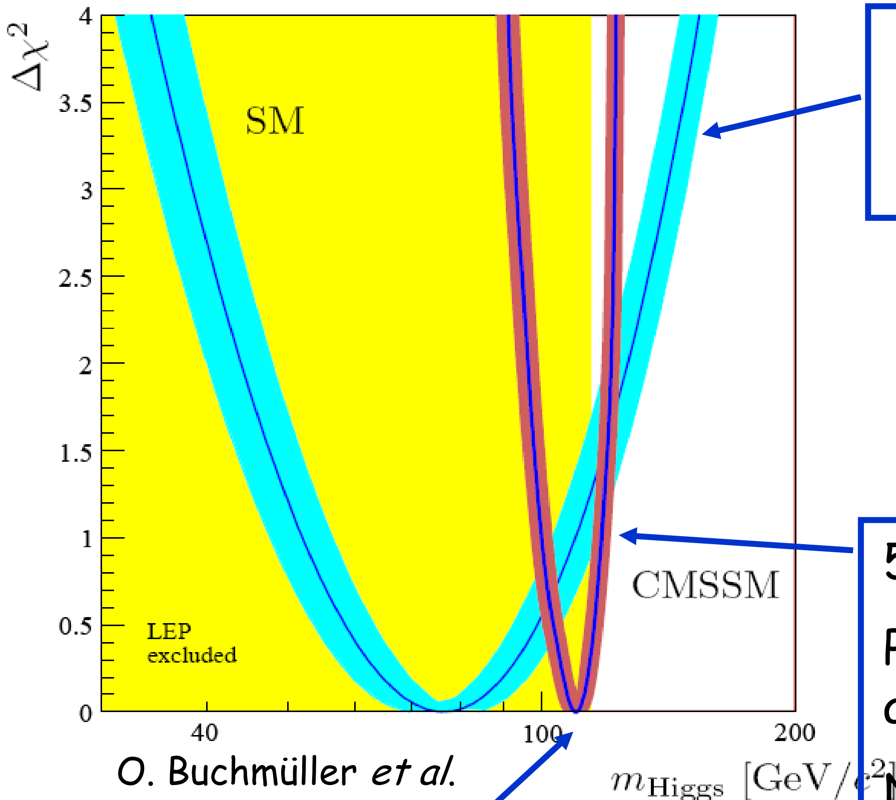
Présenté :

- Recherche du boson de Higgs standard
  - au Tevatron (update LP07 + P5)
  - au LHC
- Recherche de supersymétrie :
  - moment magnétique du muon
  - recherche indirecte de matière noire (astroparticules)

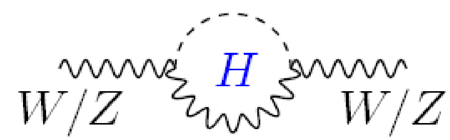
Non présenté :

- Recherche de physique au-delà du M.S. auprès des collisionneurs
- Recherche de Higgs non standards
- Développements théoriques (supersymétrie, théorie des cordes, inflation)
- Recherche directe de matière noire
- Cosmologie observationnelle

Contraintes expérimentales sur le Higgs



O. Buchmüller *et al.*
arXiv:0707.3447



M.S.

$M_H = 76^{+33}_{-24}$ GeV/c^2

M_H < 144 GeV/c^2 @ 95 % C.L.

M_H < 182 GeV/c^2 si M_H > 144.4 GeV/c$_2$

5 paramètres : $M_{1/2}$, M_0, A_0, sign(μ), tanβ

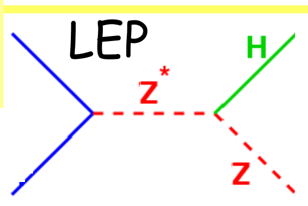
Pris en compte : eweak, $b\to s\gamma$, $B\to\mu\mu$, abondance CDM, $g_\mu-2$.

Non pris en compte : limite directe LEP.

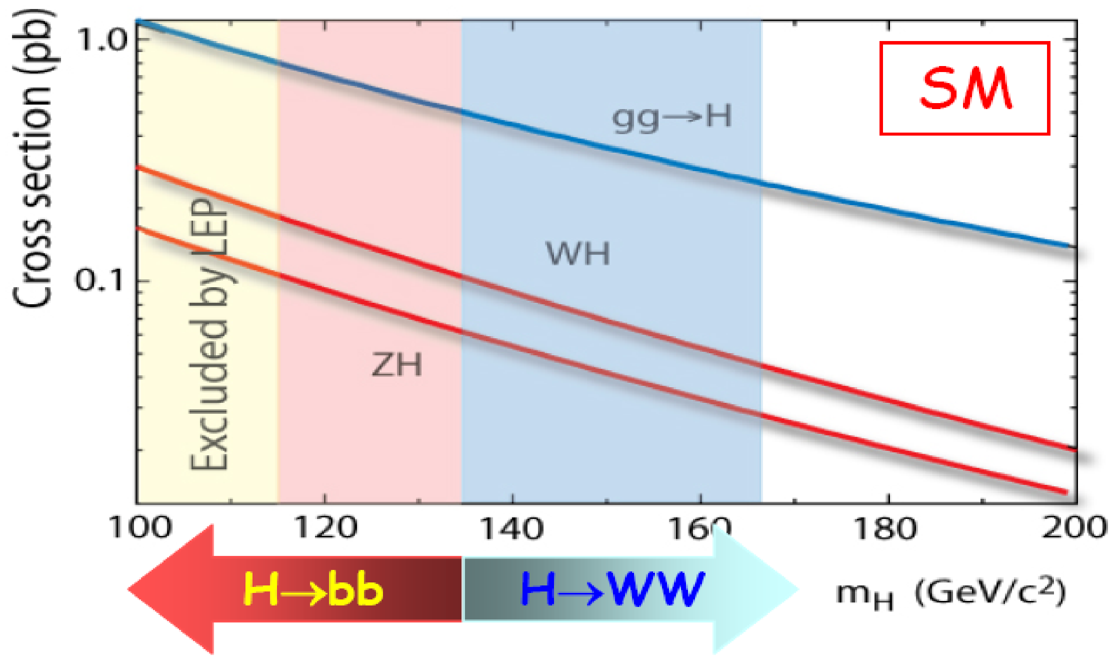
CMSSM (=? mSUGRA)

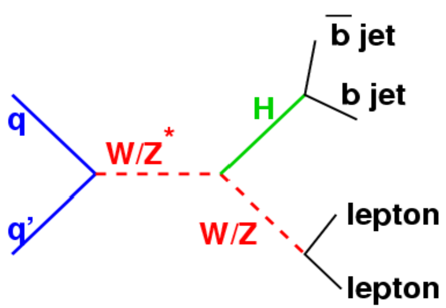
$M_h = 110^{+8}_{-10}$(exp.) ± 3 (théo.) GeV/c^2

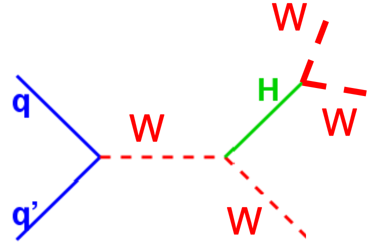
M_H > 114.4 GeV/c^2 @ 95 % C.L.

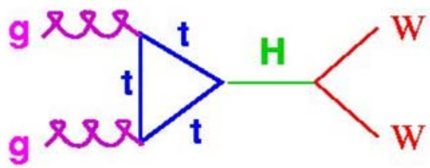


Recherche du Higgs au Tevatron







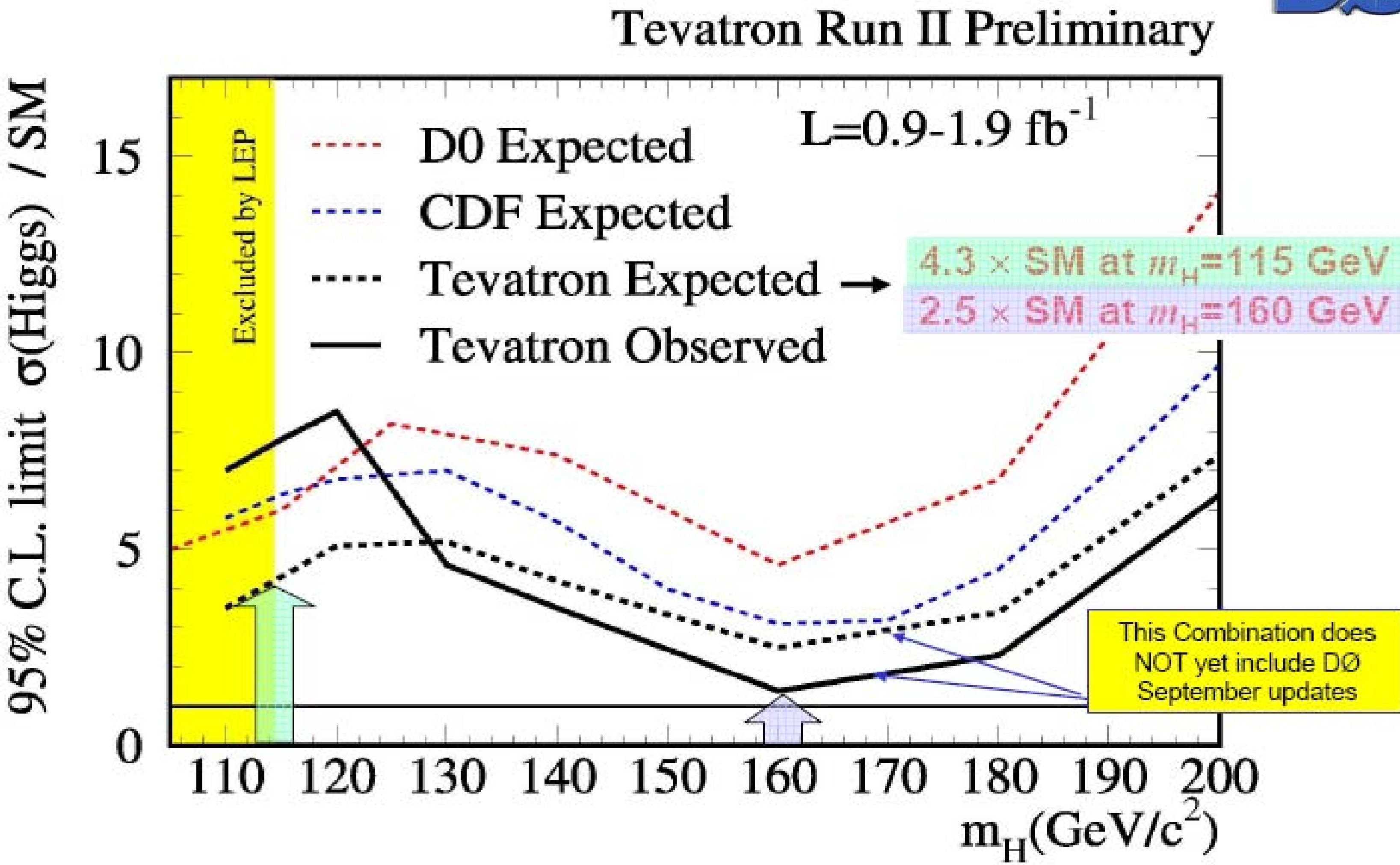


M_H <~ 135 GeV/c²

M_H intermédiaires

M_H >~ 135 GeV/c²

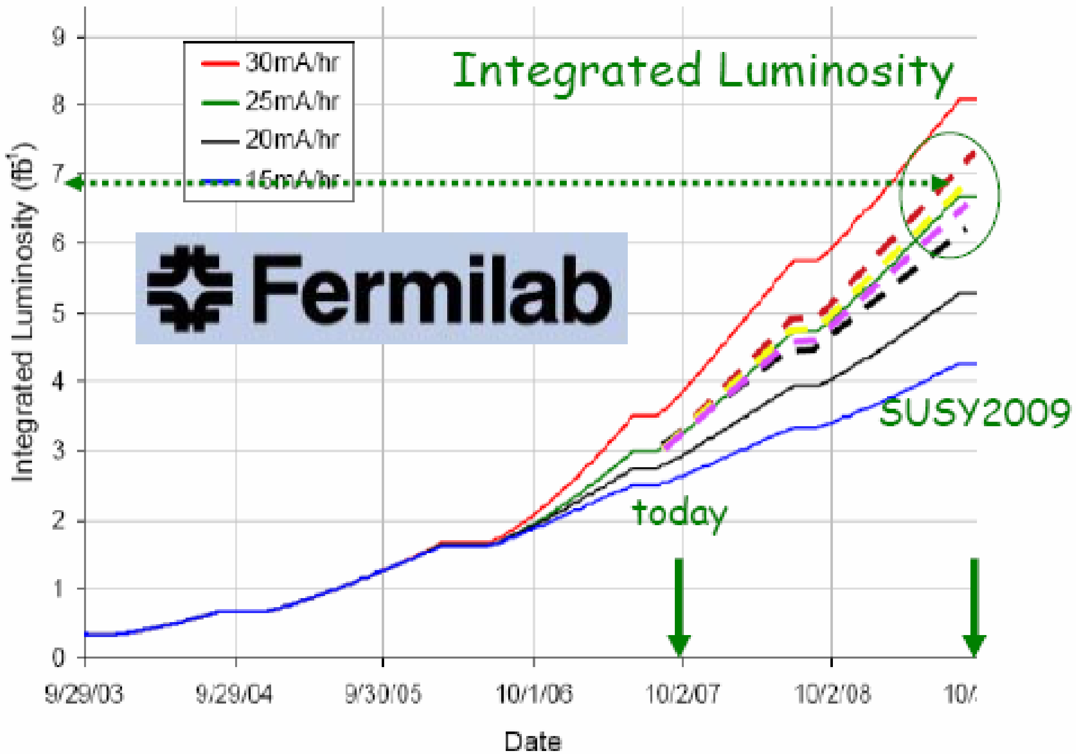
Lepton-Photon 2007



Observed limit at m_H= 160 Gev: 1.4 x SM expect.
➔ could be excluded at Moriond 2008

Tevatron Run II: Integrated Luminosity Prospects

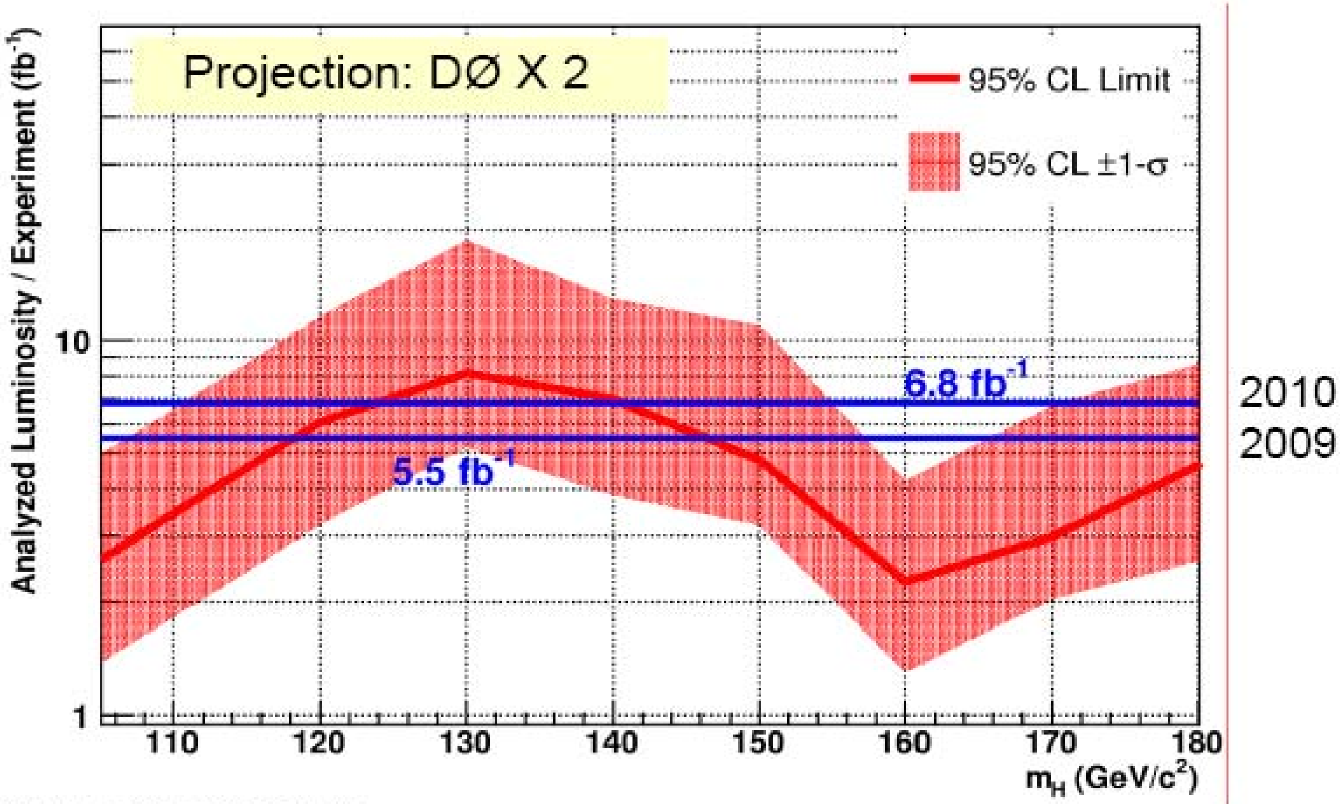
- Tevatron Run II will provide ~7 fb^{-1} more data yet to be searched through the end of 2009
- Significantly better than the baseline projection formulated in 2003
- A great achievement from the Tevatron



The search for the Higgs bosons and physics beyond the Standard Model will greatly benefit from this integrated luminosity

Run du Tevatron en 2010 ? → 8.5 fb^{-1} délivrés/exp.

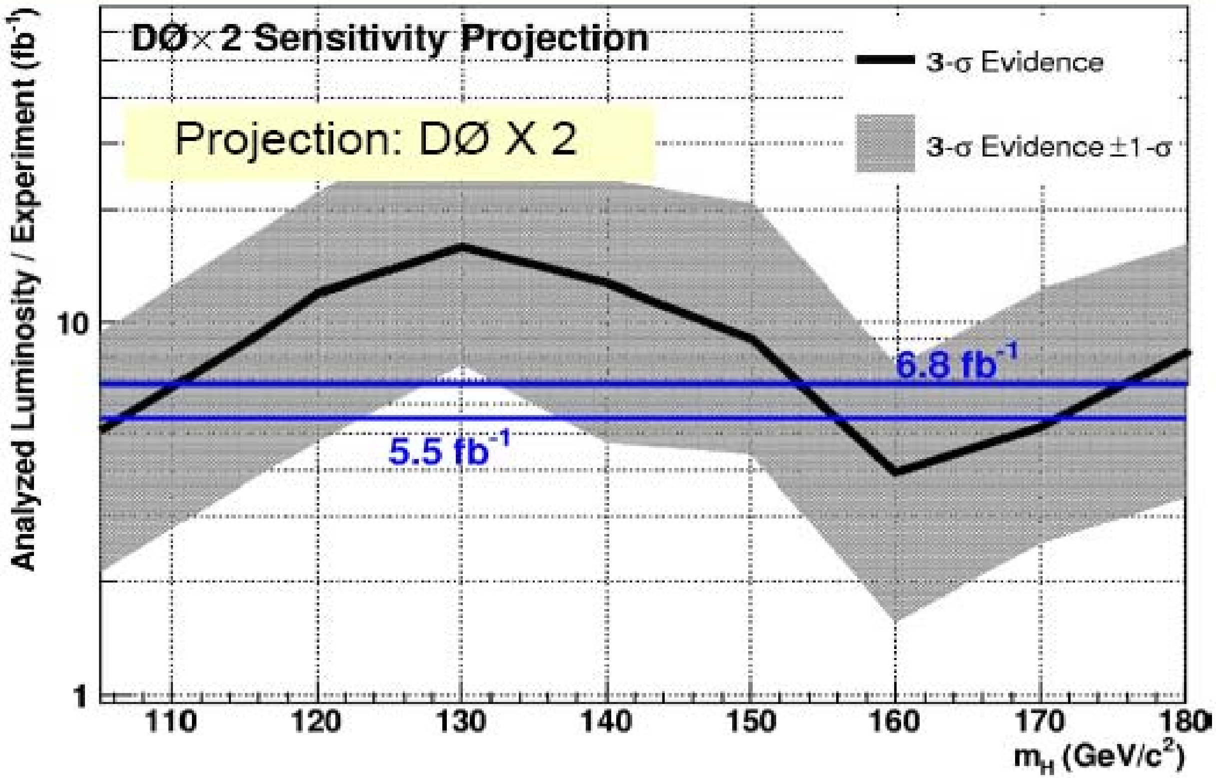
Higgs sensitivity, 95% CL



Assumes two experiments

Higgs sensitivity, 3-σ evidence

Assumes two experiments



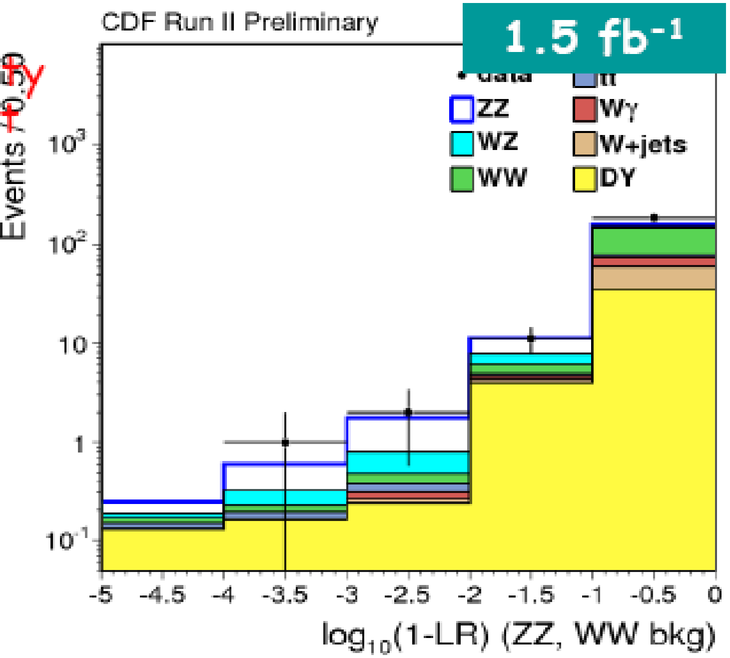
2010
2009

- **With data accumulated by the end of 2010, we will be able to explore much of the SM Higgs mass region allowed by the constraints from precision measurements and LEP direct exclusion**
  - **Expected 95% CL exclusion over whole allowed range, (except possibly around 130 GeV) - assuming the Higgs does not exist at these masses**
  - **Three-sigma evidence for a Higgs possible over almost entire range, and probable for the low end and high end.**

First hints of ZZ

- $p\bar{p}$ -> ZZ is the smallest σ measured at the Tevatron: σ_{NLO}=1.4 pb
- D0: 1 eeμμ candidate, expected ~ 1.5: σ < 4.3 pb (95%CL)
- CDF has combined 4l & llνν channel:
  - ⇒ 1 eeμμ candidate; expected ~ 2.5
  - ⇒ For llνν use an event-by event probability and construct a discriminant which is fit to extract the signal

$$\sigma(p\bar{p} \rightarrow ZZ) = 0.75^{+0.71}_{-0.54}\,\mathrm{pb}$$



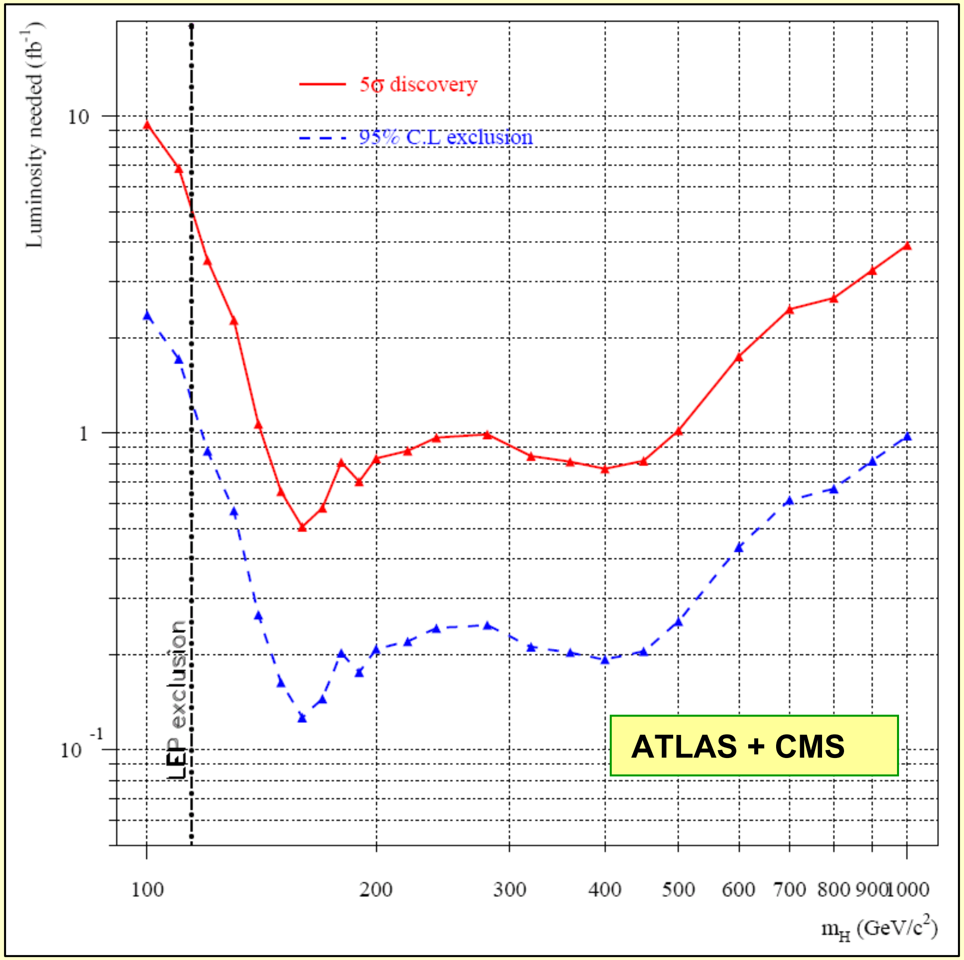
1 - Likelihood ratio for llνν

- Significance : 3.0 σ
- CDF is updating the WZ and ZZ results soon with 2 fb^{-1} "stay tuned ..."

Combined ATLAS + CMS discovery potential

(K. Jakobs SUSY07 plenary)

- Luminosity required for a 5σ discovery or a 95% CL exclusion -



J.J. Blaising et al, Eur. Strategy workshop

~ 5 fb^{-1} needed to achieve a 5σ discovery
(well understood and calibrated detector)

~ < 1 fb^{-1} needed to set a 95% CL limit
(low mass ~ 115 GeV/c^2 more difficult)

comments:

- present curves assume the old ttH, H→ bb performance
- systematic uncertainties assumed to be luminosity dependent
  (no simple scaling, σ ~ √L, possible)

densité de matière dans l'Univers

1) $\Omega_{lumineuse}$ = 0.003

2) $\Omega_{matière}$ = 0.27

3) Ω_{baryon} = 0.04 (dépend de la valeur de H_0)

⇨ $\Omega_{baryon} >> \Omega_{lumineux}$

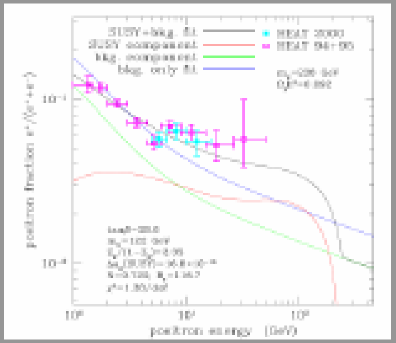
Donc il y a des **sources inconnues de baryons non lumineux** dans l'Univers.

⇨ $\Omega_{baryon} << \Omega_{matière}$

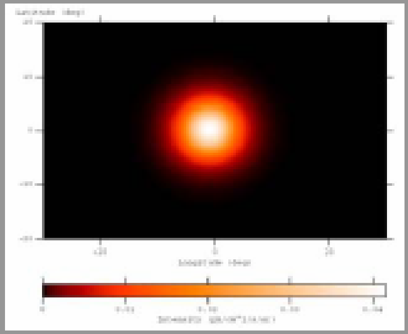
il y a une **source inconnue de matière non baryonique** dans l'Univers.

→ Recherche directe et indirecte de WIMPS

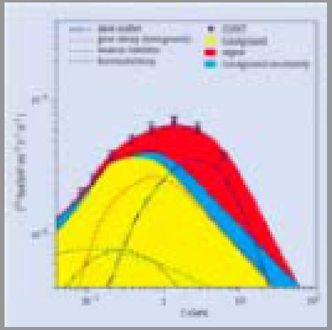
Hints Of Dark Matter Annihilation?



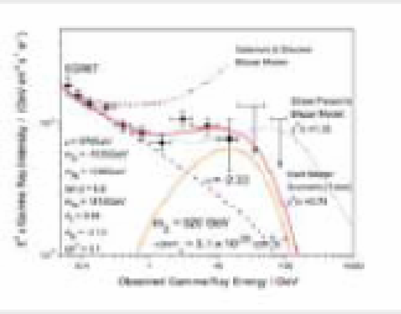
- The HEAT positron excess



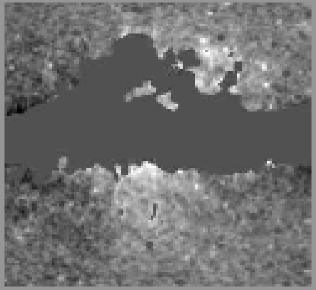
- 511 keV emission from the galactic bulge



- EGRET's galactic gamma ray spectrum



- EGRET's extragalactic gamma ray spectrum



- The WMAP haze

Dan Hooper - *Indirect Searches For Particle Dark Matter* (SUSY07 plenary)

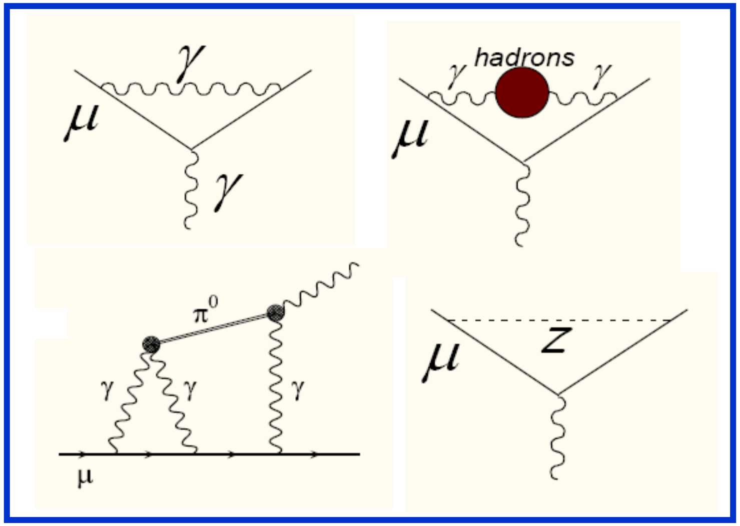
Muon g-2

- **Exp.** : résultat final de E821

$a_\mu = g_\mu - 2 \,/\, 2 = 116\ 592\ 080\ (63) \times 10^{-11}$

PRD 73 (2006) 072003

- **Prédictions S.M.** :



QED : 116 584 719 (1) $\times 10^{-11}$

Hadronic : LO : +6908 (44) $\times 10^{-11}$ hep-ph/0701163

NLO : -98 (1) $\times 10^{-11}$

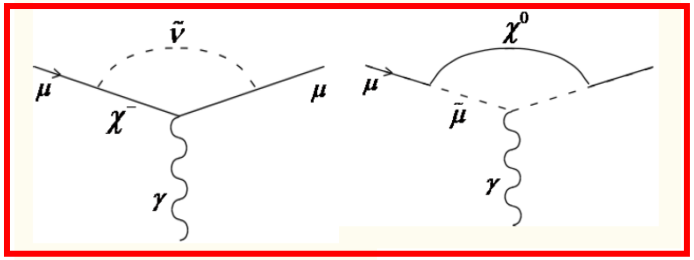
LBL : +120 (40) $\times 10^{-11}$

EW : + 154 (3) $\times 10^{-11}$

⇨ **prédictions S.M. – exp.** = 277 (87) $\times 10^{-11}$

→désaccord 3.2 s

→ contributions SUSY ?

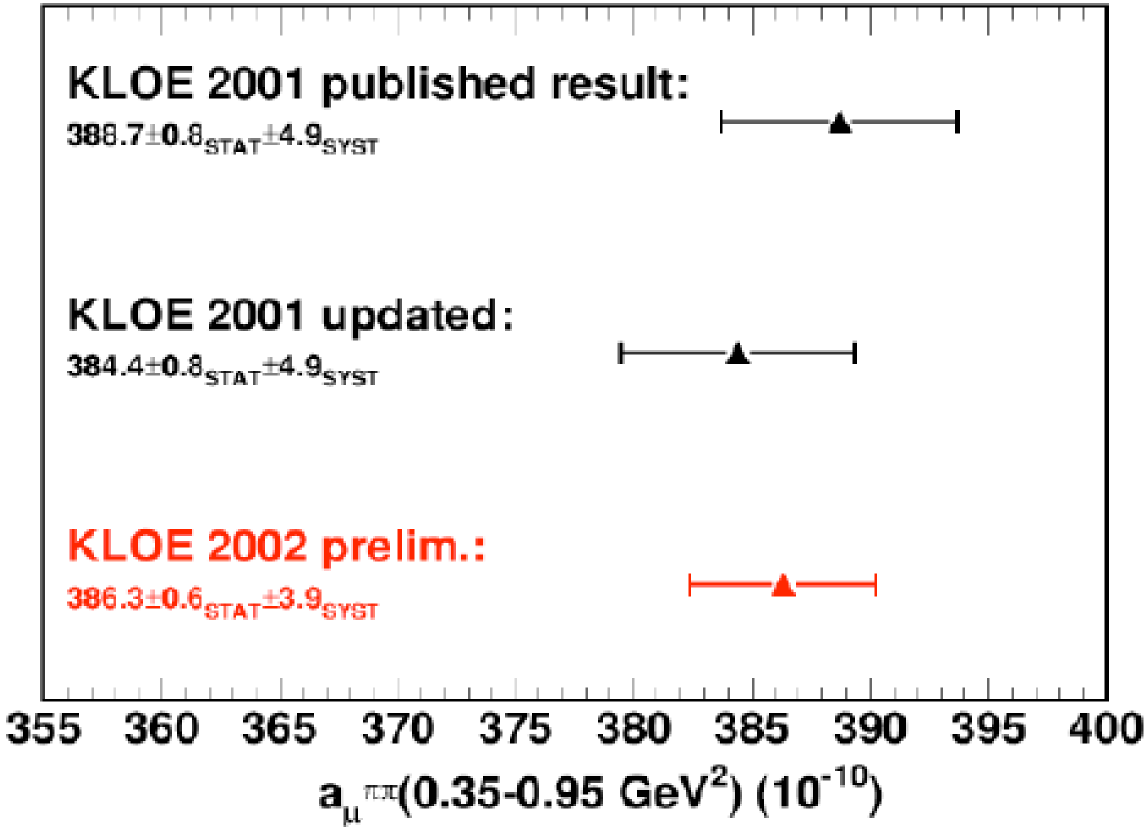


Futur : BaBar, Belle, KLOE, VEP2000 (Novosibirsk).

New results from KLOE presented last week at EPS Manchester

Preliminary!!!

Summary of the small angle results:



Jegerlehner (hep-ph/0703125): $\Delta a_\mu = a_\mu^{exp} - a_\mu^{the} = (28.7 \pm 9.1) \cdot 10^{-10}$

Using new KLOE result would increase difference from 3.2σ to 3.4σ

(A. Czarnecki SUSY07 plenary)

(J. Ellis SUSY07 plenary)

Possible Nature of NLSP if GDM

- NLSP = next-to-lightest sparticle
- Very long lifetime due to gravitational decay, e.g.:

$$\Gamma_{\tilde{\tau} \to \tilde{G} \tau} = \frac{1}{48\pi} \frac{1}{M_P^2} \frac{m_{\tilde{\tau}}^5}{m_{3/2}^2} \left(1 - \frac{m_{3/2}^2}{m_{\tilde{\tau}}^2}\right)^4$$

- **Could be hours, days, weeks, months or years!**
- Generic possibilities:

  lightest neutralino χ

  lightest slepton, lighter stau or sneutrino?
- Constrained by astrophysics/cosmology

Very little room for water tank in LHC caverns, only in forward directions where few staus

(J. Ellis SUSY07 plenary)

Extract Cores from Surrounding Rock?

- Use muon system to locate impact point on cavern wall with uncertainty < 1cm
- Fix impact angle with accuracy 10^{-3}
- Bore into cavern wall and remove core of size 1cm $\times$ 1cm $\times$ 10m = 10^{-3}m^3 ~ 100 times/year
- Can this be done before staus decay?

    Caveat radioactivity induced by collisions!

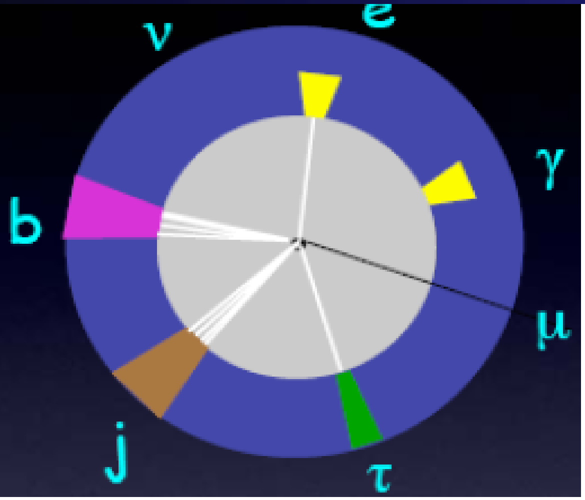
    2-day technical stop ~ 1/month

- Not possible if lifetime ~10^4s, possible if ~10^6s?

De Roeck, JE, Gianotti, Moortgat, Olive + Pape: hep-ph/0508

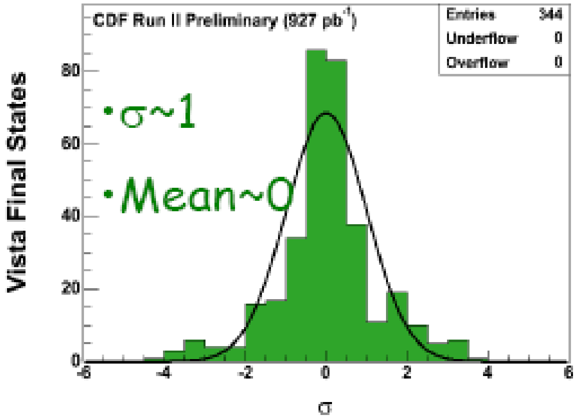
Model Independent Searches

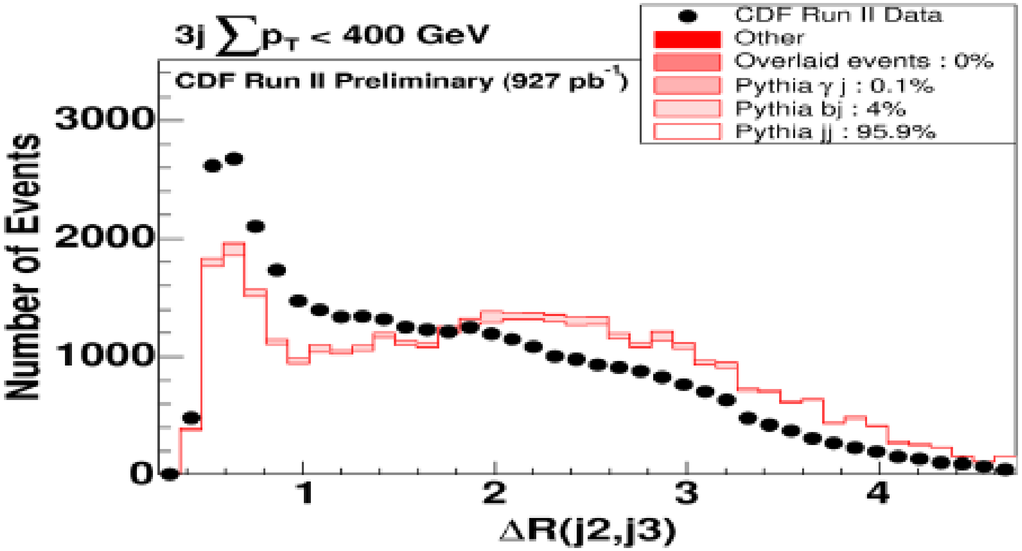
Georgios Choudalakis's talk



- A global analysis of CDF Run II data :
  - Vista :

Vista



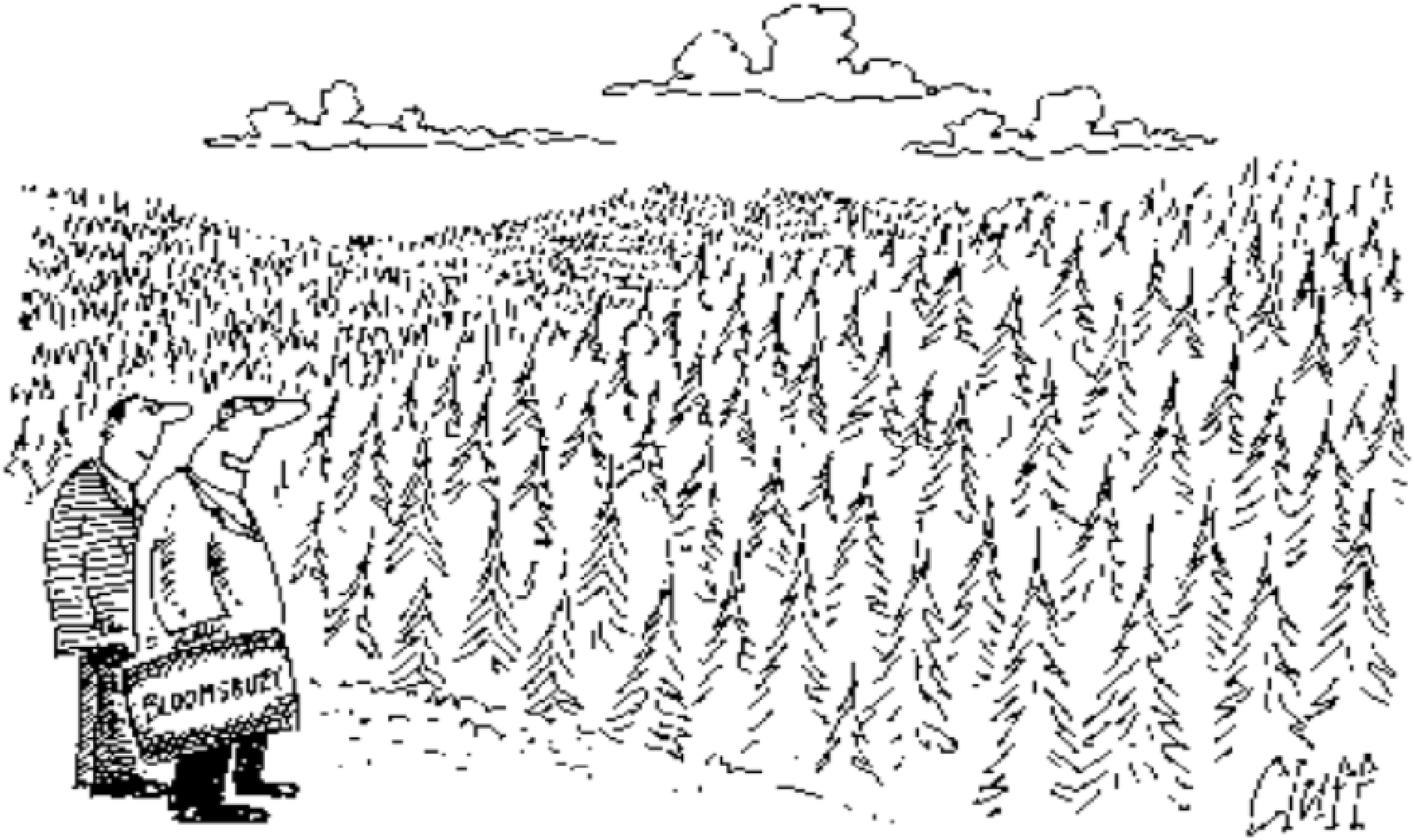


• in few cases: apparent difference between the field's state-of-the-art showering algorithms and data

SUSY08

Seoul, Korea, 06/16/08 → 06/21/08

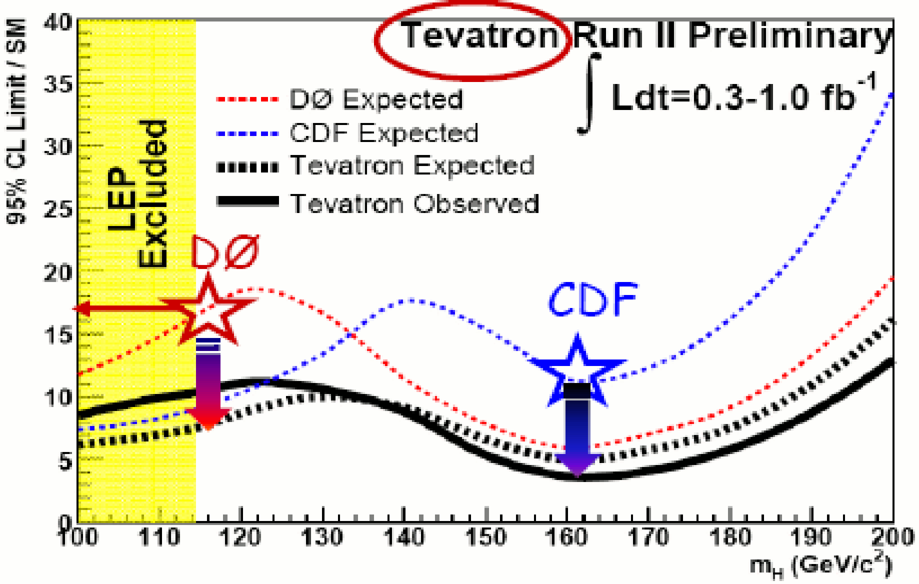
http://susy08.kias.re.kr



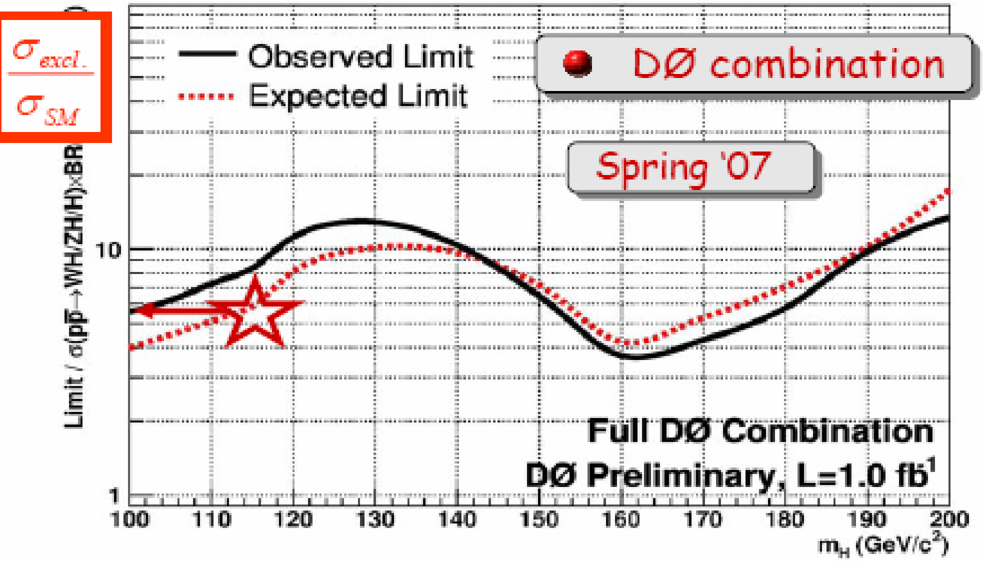
"One day, all of these will be supersymmetric phenomenology papers."

BONUS

SM Higgs Combination : Tevatron combination



- Summer `06: 1st DØ+CDF combination with ~ 0.3-1.0 fb^{-1}
- Since then: lots of progress
  - better sensitivity in all channels
  - NN b-tag or selection, ME,..
  - equivalent to x2 more luminosity!



- ex: DØ alone has tighter limits
  - X factor of ~ 3 at low mH
  - progress faster than √L gain
- New results coming soon & Will be followed by an updated combination

Tevatron SM Higgs Sensitivity

- Though we are not quite there, we know we are missing pieces:
  - Advanced analysis selections (example of improvements demonstrated in previous slides)
  - Missing channels in the combination ($WH \to WWW$, single/double tag combinations, ...)
  - New channels (taus, $H \to ZZ$, hadronic $H \to WW$, ...) in the pipeline
  - Improve systematic uncertainties, New SMT Layer 0 @DØ

Ingredient	Equiv Lumi Gain	Xsec Factor MH=115 GeV	Xsec Factor MH=160 GeV
Today with $1 fb^{-1}$	-	5.9	4.2
Lumi = $2 fb^{-1}$	2	4.2	3.0
b-Tag (Shape + LayerØ)	1.5	3.4	3.0
Multivariate Techniques	1.7	2.6	2.3
Improved mass resolution	1.5	2.1	2.3
New Channels	1.3/ 1.5	1.9	1.9
Reduced systematics	1.2	1.7	1.7
Two Experiments	2	1.2	1.2

DØ + CDF to reach 95% C.L. exclusion :

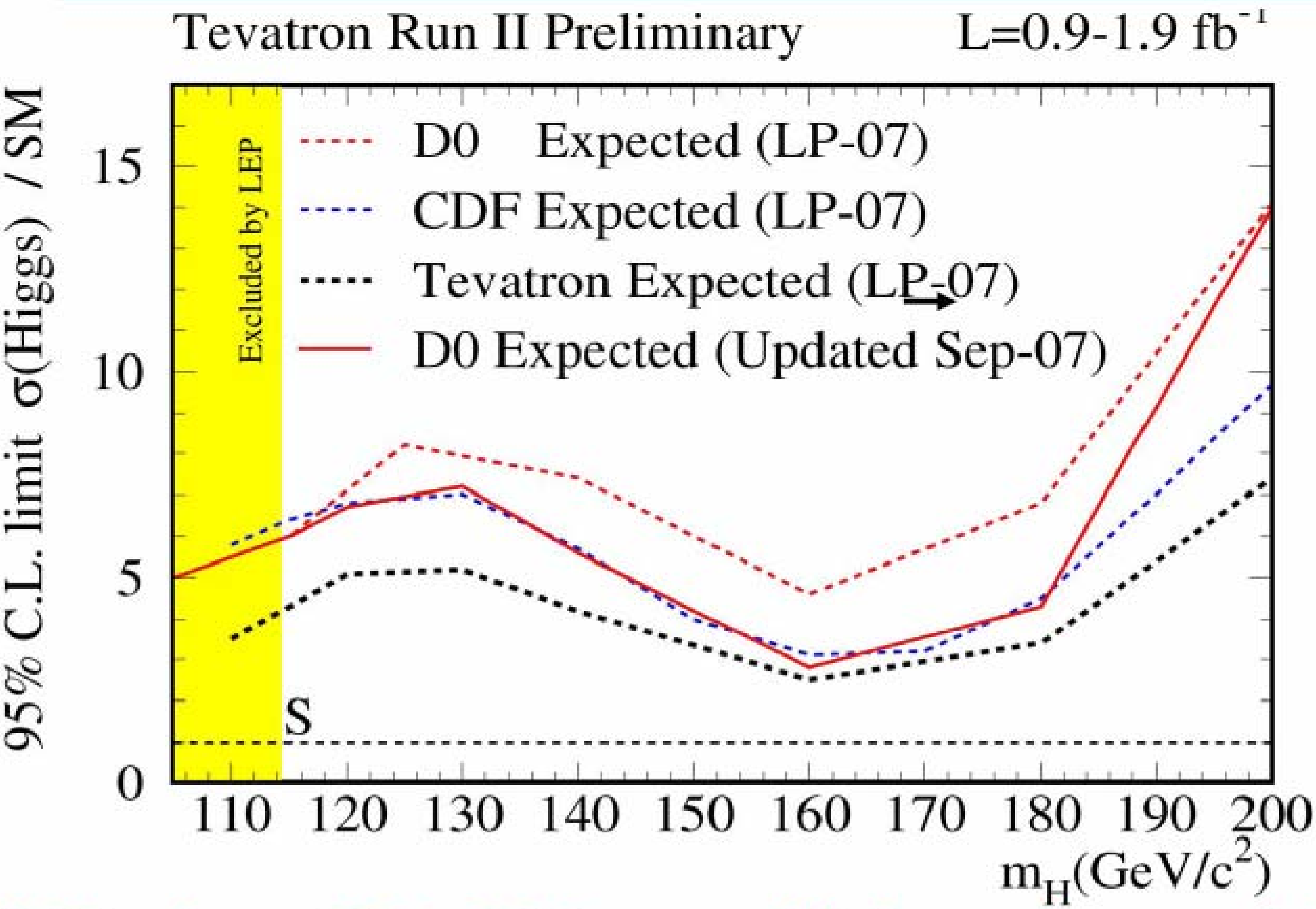
- mH~115 GeV ⇒ need 3 fb^{-1}
- mH~160 GeV ⇒ need 3 fb^{-1}

Combining the Results

Channel	Lumi /Technique	Final state	#chan.
WH→lν bb	1.7 fb^{-1} / NN	e/μ, 1b/2b	2*(2+2)
ZH→ll bb	1.1 fb^{-1} / NN	e/μ, 1b/2b	2+2
ZH→νν bb	0.9 fb^{-1} / Dijet mass	Z→νν, W→ł̶ν (2b)	2
H→WW*	1.7 fb^{-1} /NN's	ee, eμ, μμ	2*3
WH→WWW*	1 fb^{-1} / 2D LHood	ee, eμ, μμ	3

Total of 23 channels combined (tau-channel not included yet)

After P5 Updates (2 days ago)



With P5 updates, CDF and DØ expected limits are the same →180 GeV

Expected combination ~ 1.9 × SM at m_H=160 GeV

Sensitivity and Projections – M_H = 115 GeV

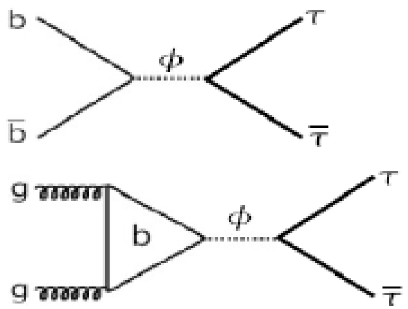
- Since 2005, our analysis sensitivity has improved by a factor of 1.7 beyond improvement expected from sqrt(luminosity)
  - Acceptance/kin. phase space
  - Asymmetric tagging for double b-tags
  - b-tagging improvements (NN b-tagging)
  - Triggers "OR"ing
  - improved statistical techniques
  - event NN discriminant
  - → for channel with largest effort applied (WH) factor was 2.1

- For 2010, we estimate that we will gain an additional factor of 2.0 beyond improvement expected from sqrt(luminosity)
  - update ZH→vvbb with Neural Net
  - add single-b-tag channel to ZH→vvbb
  - include forward electrons in WH
  - include 3-jet sample in WH
  - b-tagging improvements
    - Layer 0 (~8% per tag efficiency increase)
    - add semileptonic b-tags (~5% per tag efficiency increase)
  - Di-jet mass resolution (18% to 15% in $\sigma(m)/m$)
  - increased lepton efficiency (10% per lepton)
  - improved/additional multivariate techniques (~20% in sensitivity)

Neutral MSSM Higgs: di-tau SUSY Higgs Decays

Tim Scanlon's talk

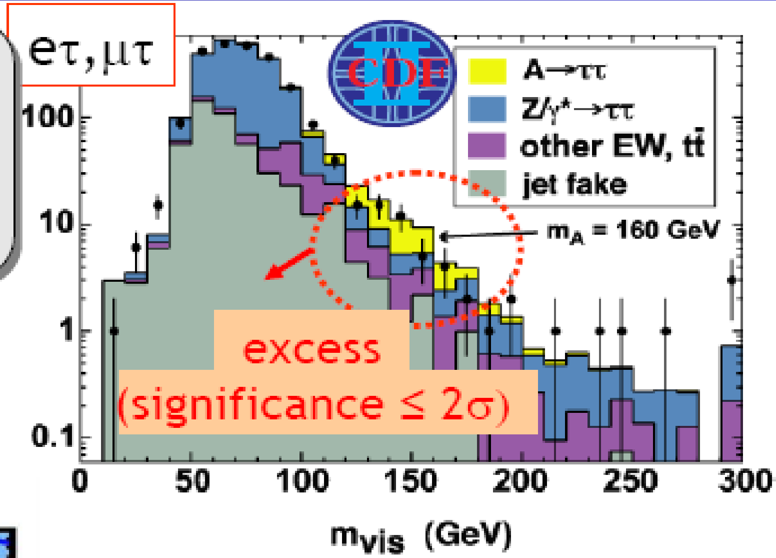
Ilya Kravchenko's talk

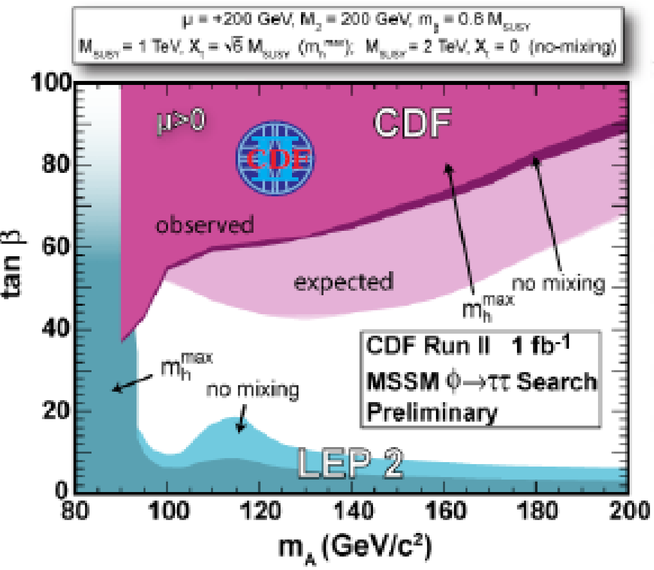


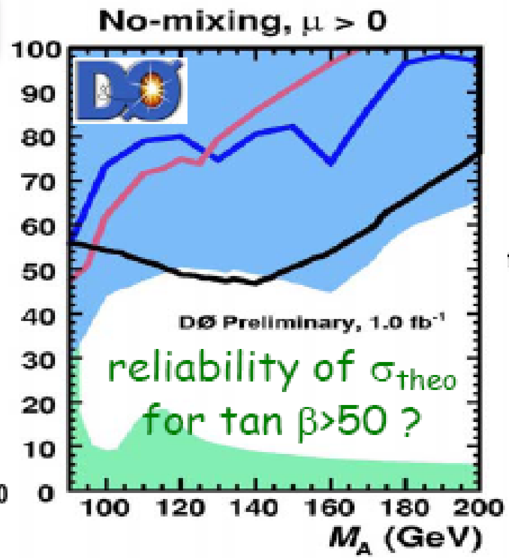
- CDF: τ cone size select.
  - $\tau_e\tau_{had}$, $\tau_\mu\tau_{had}$, $\tau_e\tau_\mu$
- DØ: τ NN selection
  - $\tau_\mu\tau_{had}$

$\tau_e \rightarrow e\nu_e\nu_\tau \quad \tau_\mu \rightarrow \mu\nu_\mu\nu_\tau$

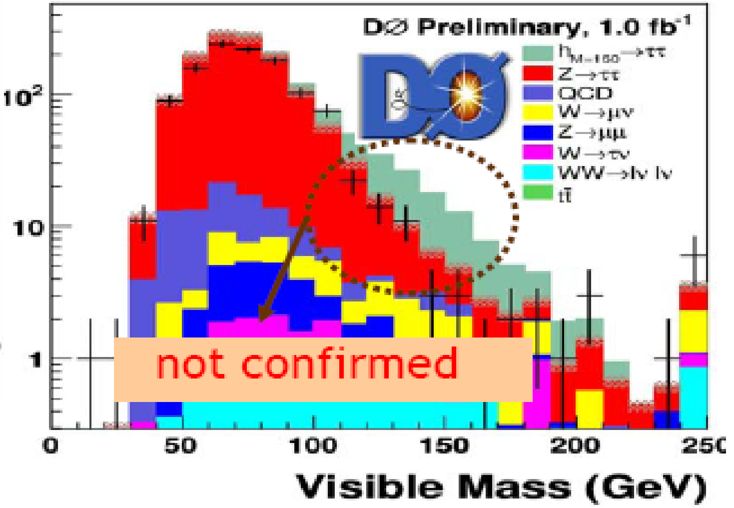
$\tau_{had} \rightarrow had \;\; \nu_\tau$







$$M_{\rm vis} = \sqrt{(P^\mu + P^\tau + \not{P}_{\rm T})^2}$$

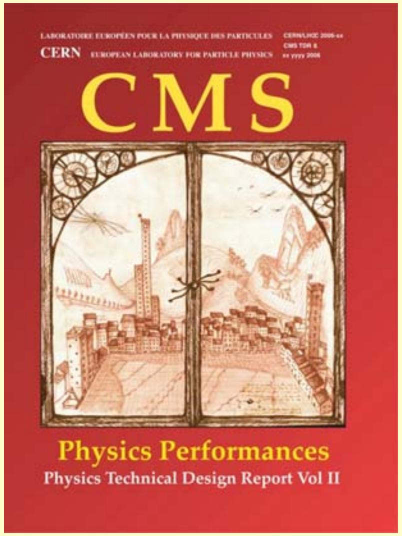


- no mixing and m_h^{max} benchmark scenario
- 90<mA<200, tan β>50 GeV excluded

(K. Jakobs plenary)

What is new on LHC Higgs studies ?

- Many studies have meanwhile been performed using detailed GEANT simulations of the detectors
  - Physics Performance Technical Design Report from the CMS collaboration
  - ATLAS CSC (Computing System Challenge) notes in preparation, to be released towards the end of 2007



CERN / LHCC 2006-021

- New (N)NLO Monte Carlos (also for backgrounds)
  - MCFM Monte Carlo, J. Campbell and K. Ellis, http://mcfm.fnal.gov
  - MC@NLO Monte Carlo, S.Frixione and B. Webber, wwwweb.phy.cam.ar.uk/theory/
  - T. Figy, C. Oleari and D. Zeppenfeld, Phys. Rev. D68, 073005 (2003)
  - E.L.Berger and J. Campbell, Phys. Rev. D70, 073011 (2004)
  - C. Anastasiou, K. Melnikov and F. Petriello, hep-ph/0409088 and hep-ph/0501130
  - …..

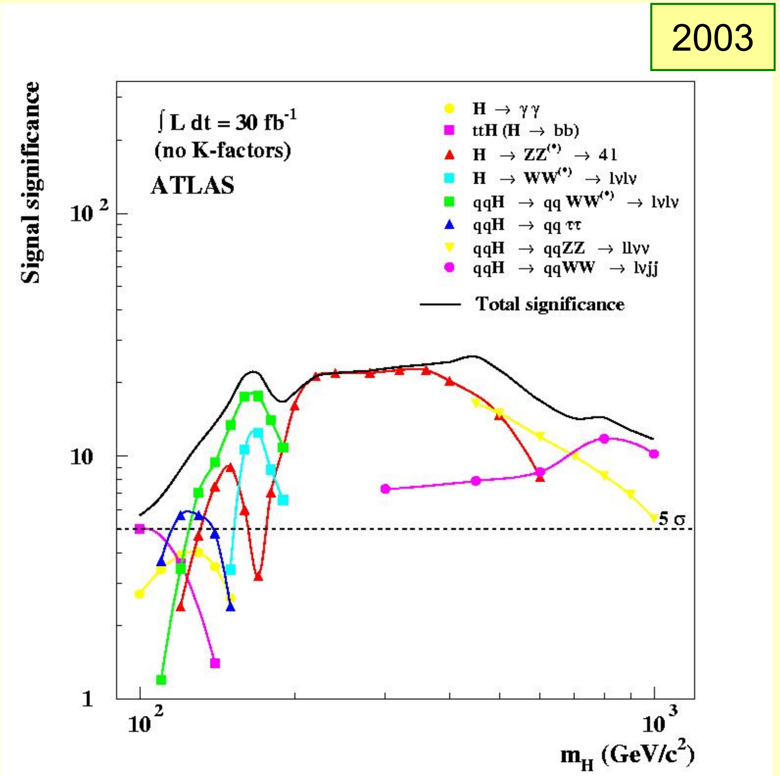
- New approaches to match parton showers and matrix elements
  - ALPGEN Monte Carlo + MLM matching, M. Mangano et al.
  - SHERPA Monte Carlo, F. Krauss et al.
  - …

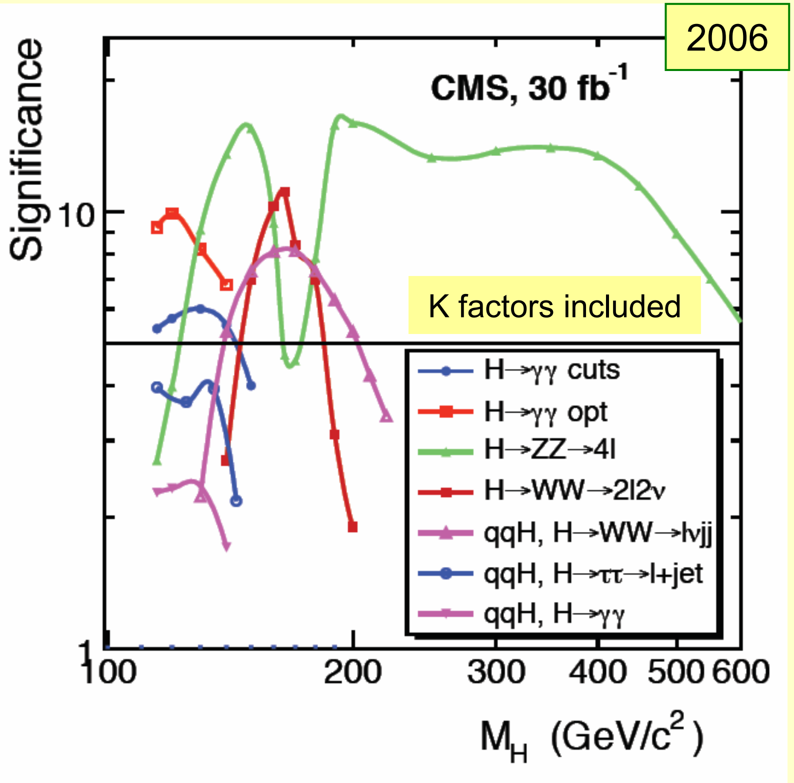
  Tevatron data are extremely valuable for validation, work has started

- More detailed, better understood reconstruction methods
  (partially based on test beam results,…)

- Further studies of new Higgs boson scenarios
  (Various MSSM benchmark scenarios, CP-violating scenarios, Invisible Higgs boson decays,…..)

LHC discovery potential for 30 fb^{-1}





- Full mass range can already be covered after a few years at low luminosity
- Several channels available over a large range of masses

  Vector boson fusion channels play an important role at low mass !

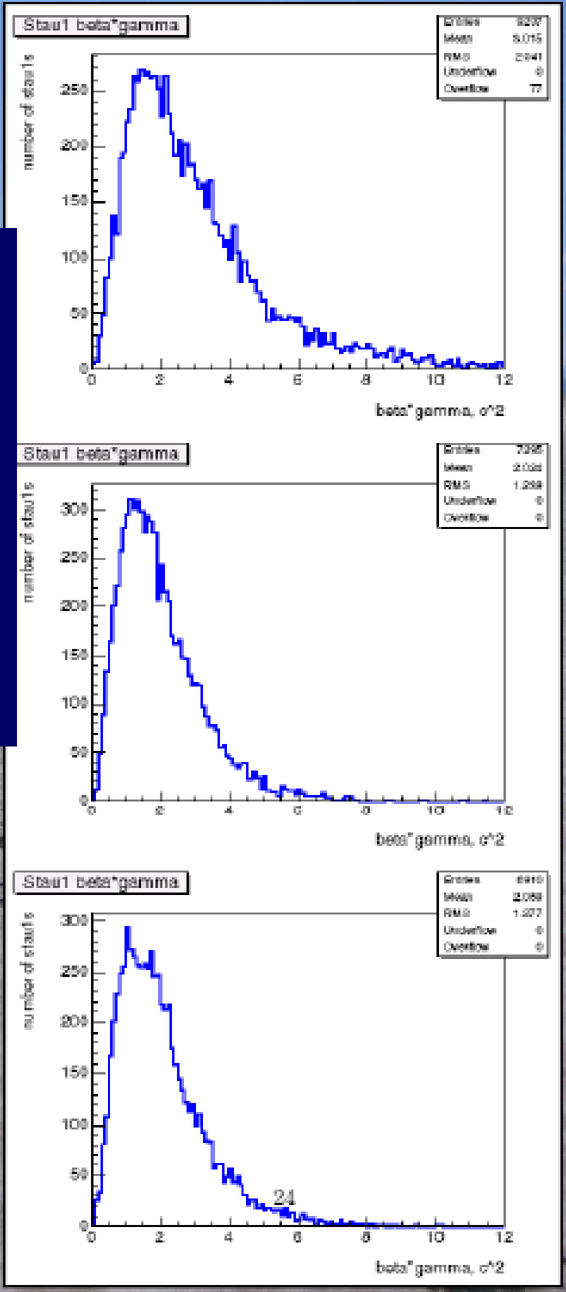
Important changes w.r.t. previous studies:

- **H → γγ** sensitivity of ATLAS and CMS comparable
- **ttH → tt bb** disappeared in CMS study (updated (ME) background estimates, under study in ATLAS)

Stau Momentum Spectra

- $\beta\gamma$ typically peaked ~ 2
- Staus with $\beta\gamma < 1$ leave central tracker after next beam crossing
- Staus with $\beta\gamma < 1/4$ trapped inside calorimeter
- Staus with $\beta\gamma < 1/2$ stopped within 10m
- **Can they be dug out of cavern wall?**

Model	ϵ	ζ	η
Number of particles with $\beta\gamma < 0.25$	850	7	7
Range in C (cm)	60	136	129
Range in Fe (cm)	29	65	61
Number of particles with $\beta\gamma < 0.5$	7700	100	90
Range in C (cm)	600	1360	1290
Range in Fe (cm)	290	650	610



De Roeck, JE, Gianotti, Moortgat, Olive + Pape: hep-ph/0508198

Mw : CDF Result

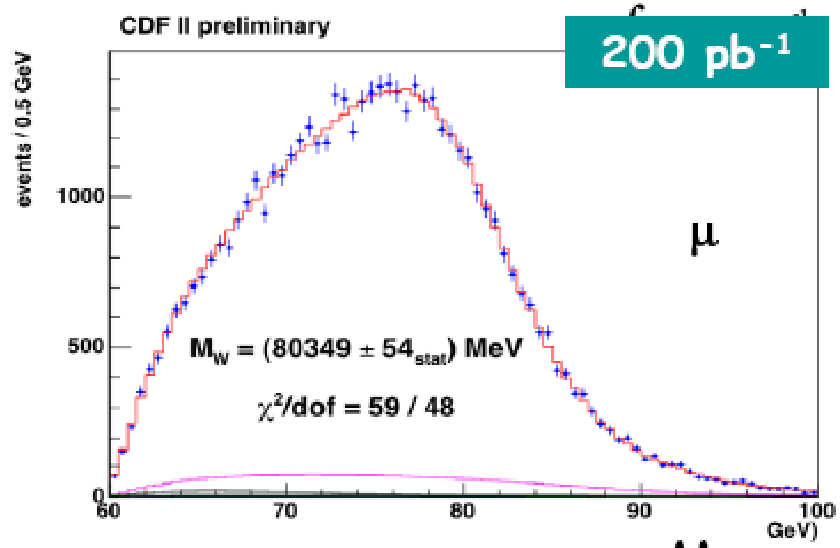
CDF II preliminary L = 200 pb^{-1}

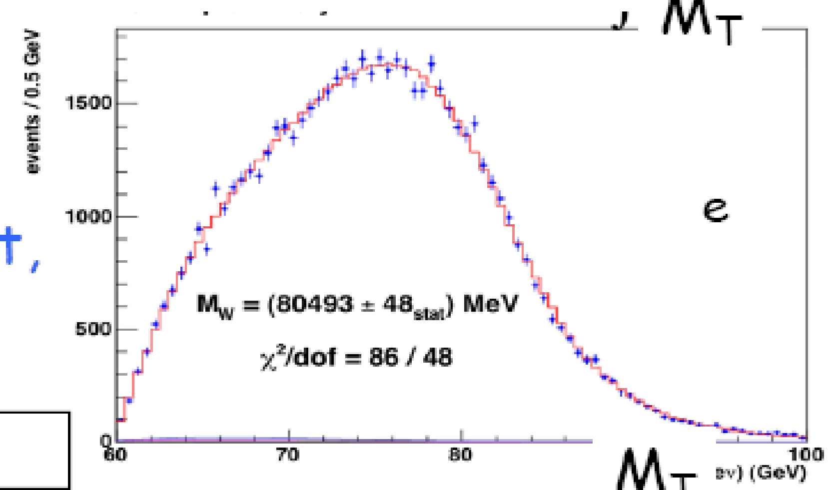
m_T Uncertainty [MeV]	Electrons	Muons	Common
Lepton Scale	30	17	17
Lepton Resolution	9	3	0
Recoil Scale	9	9	9
Recoil Resolution	7	7	7
$u_{\parallel}$ Efficiency	3	1	0
Lepton Removal	8	5	5
Backgrounds	8	9	0
$p_T(W)$	3	3	3
PDF	11	11	11
QED	11	12	11
Total Systematic	39	27	26
Statistical	48	54	0
Total	62	60	26

$$M_W = 80413 \pm 48 \text{ MeV}$$

the best single-experiment result, now statistically limited

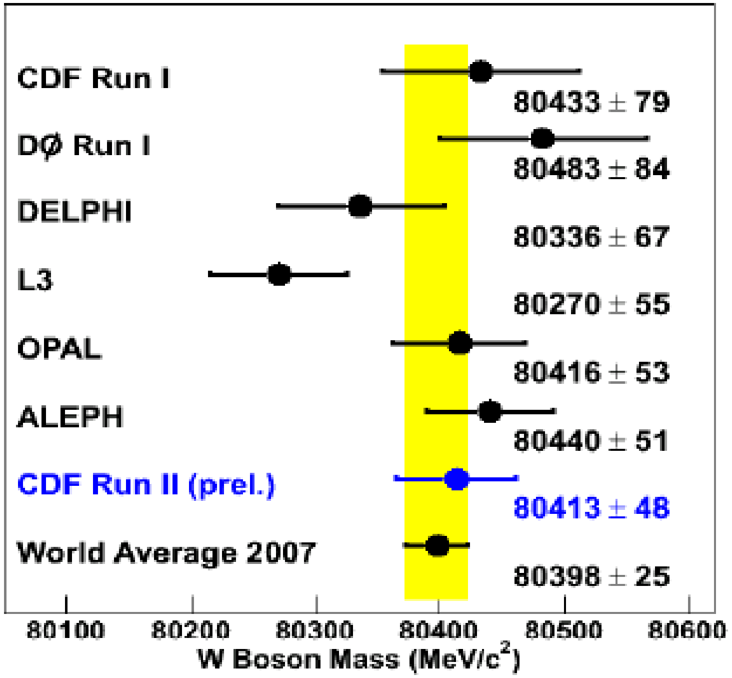
Submitted to PRL hep-ex/0707.0085

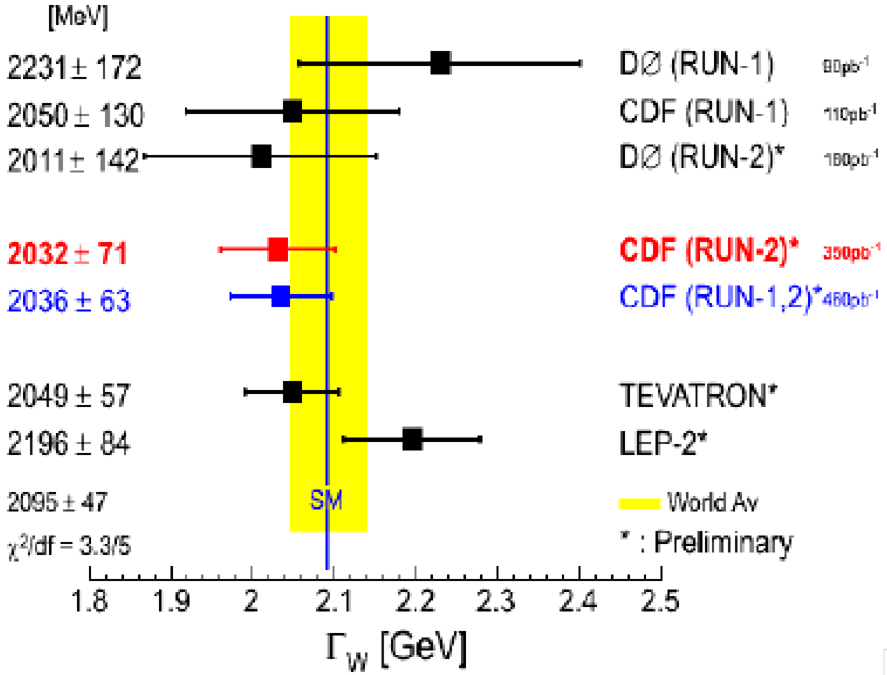




Summary for M_W and Γ_W

- CDF has most precise single experiment measurements of the W boson mass and width.





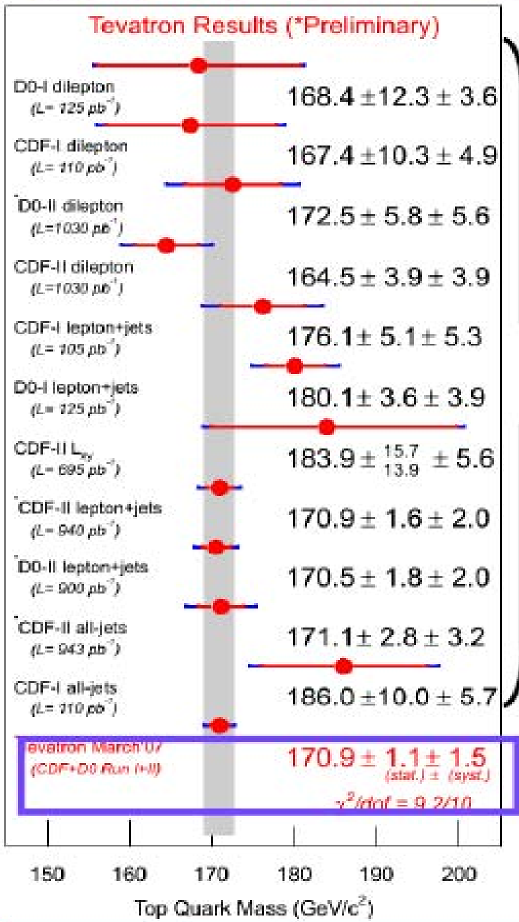
Reduces uncertainty on world average by 15%:

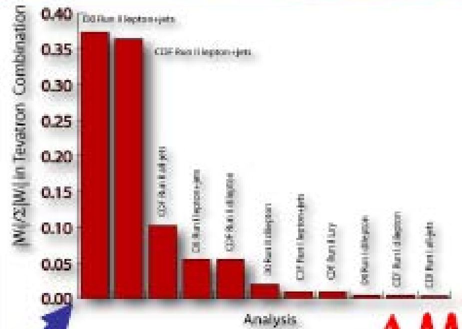
29 → 25 MeV

Reduces uncertainty on world average by 22%

60 → 47 MeV

Summary of top mass measurements





The top quark mass is known with a precision that was thought unreachable at the Tevatron only a few years ago:

$\Delta M/M \sim 1.1\%$

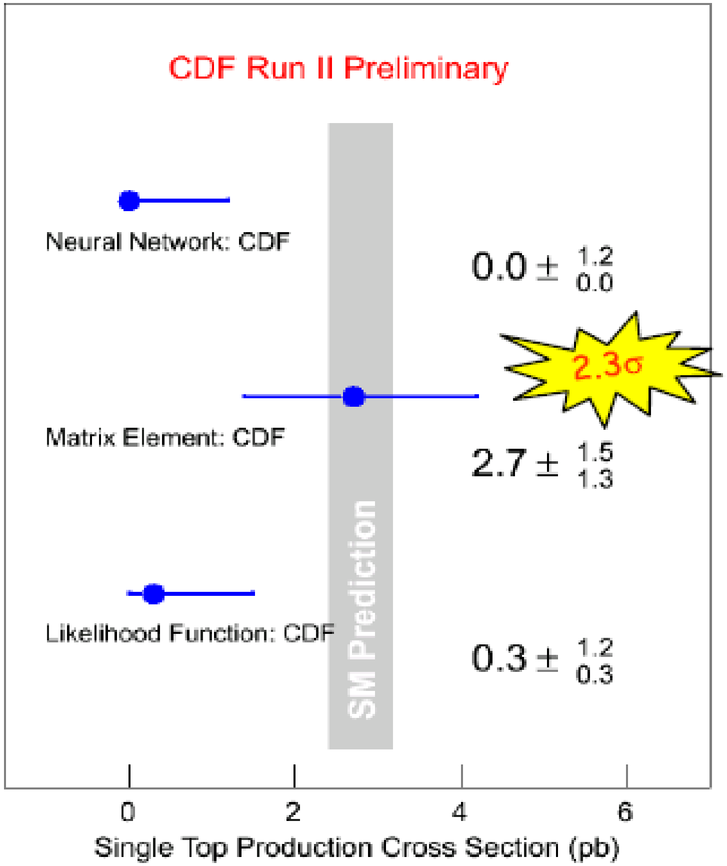
of the order of the top natural width

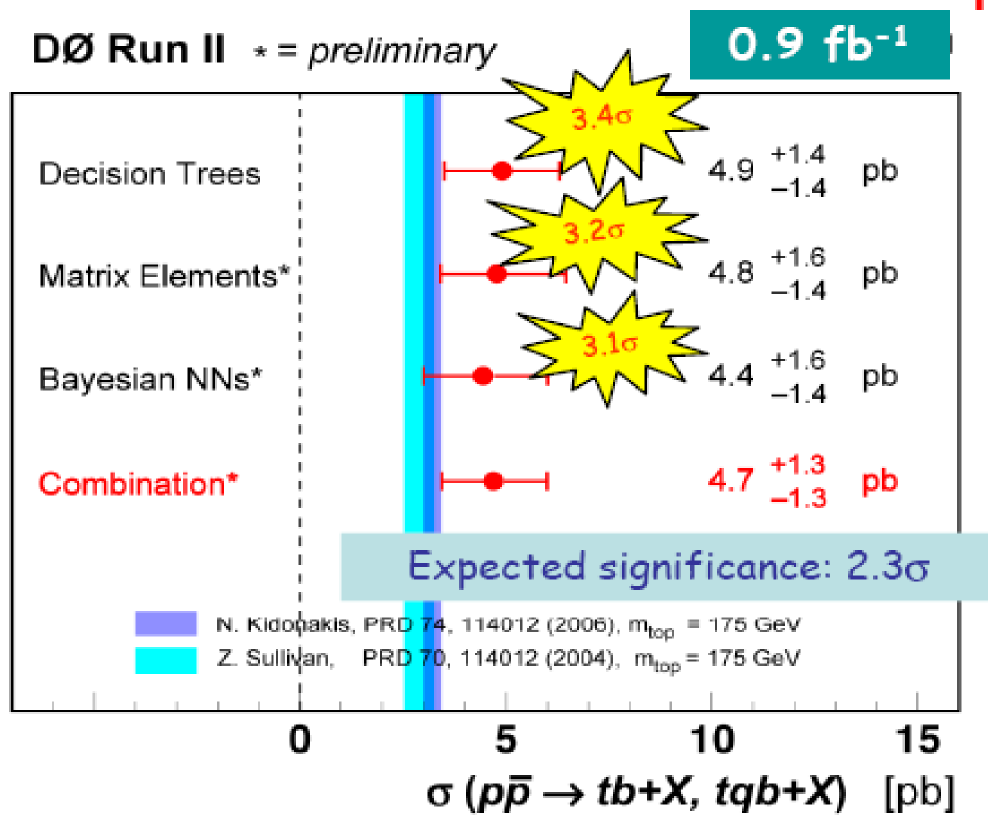
⇨be careful in interpreting the meaning of the measurement

⇨ both exp.s are addressing a number of effects that, too small to have an impact in the first measurements, can now become important.

⇨ reconsider which theoretical aspects are relevant, at the 1 GeV level, and whether they are sufficiently well under control.

All Single Top Results





First direct limit on V_{tb}:
$0.68 < |V_{tb}| < 1$ at 95%CL

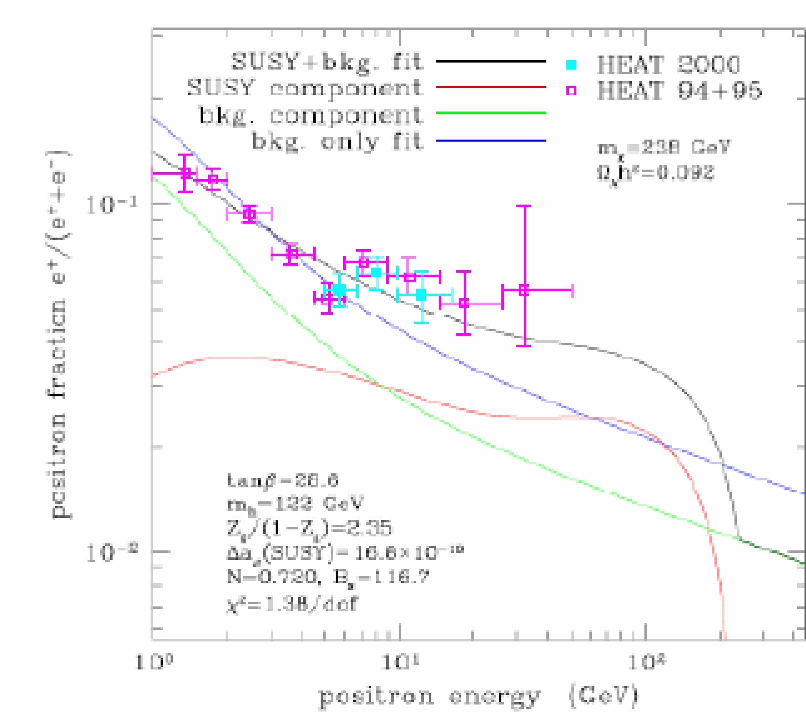
DØ Combination: 3.6σ

The HEAT Positron Excess

•In its 1994-95, 2000 flights, the HEAT balloon-based cosmic ray detector observed an excess of positrons relative to electrons in the 7-30 GeV range

•Measurements from AMS-01 add some support (see talk by Jan Olzem)

•Combined statistical significance of several (4-5) sigma, neglecting (likely important, but difficult to evaluate) systematic uncertainties



E. Baltz and J. Edsjo, PRD, astro-ph/9808243

The HEAT Positron Excess

Strengths:

•Fit to data can be easily improved if dark matter component is included

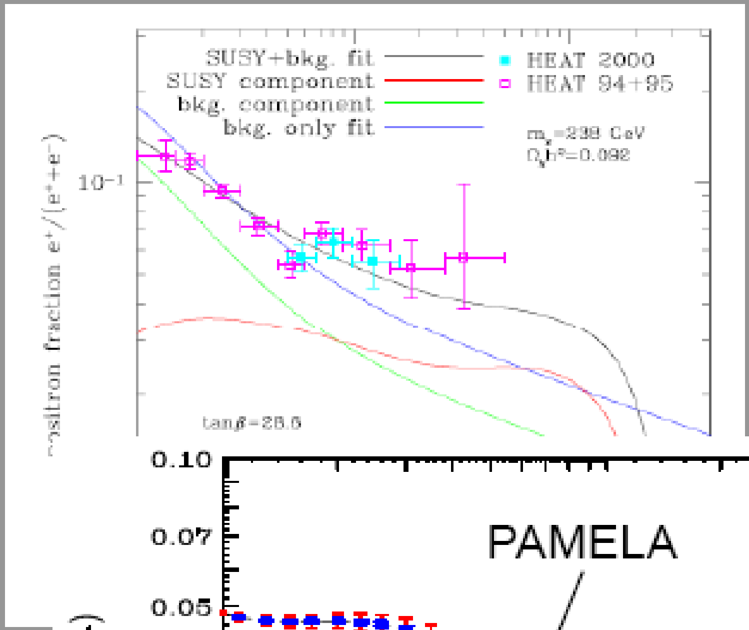
Weaknesses:

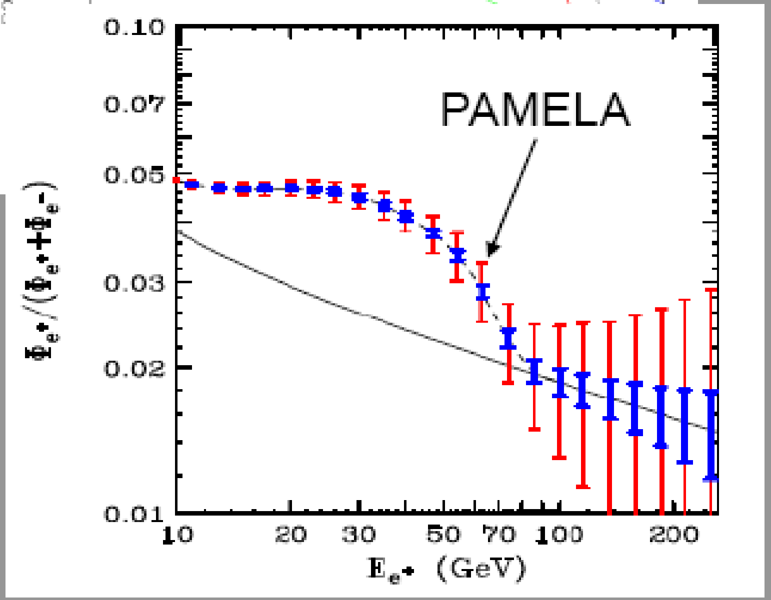
•Messy astrophysics

•Requires annihilation boost of ~50 or more (possible, but unlikely), or non-thermal dark matter production

Prospects:

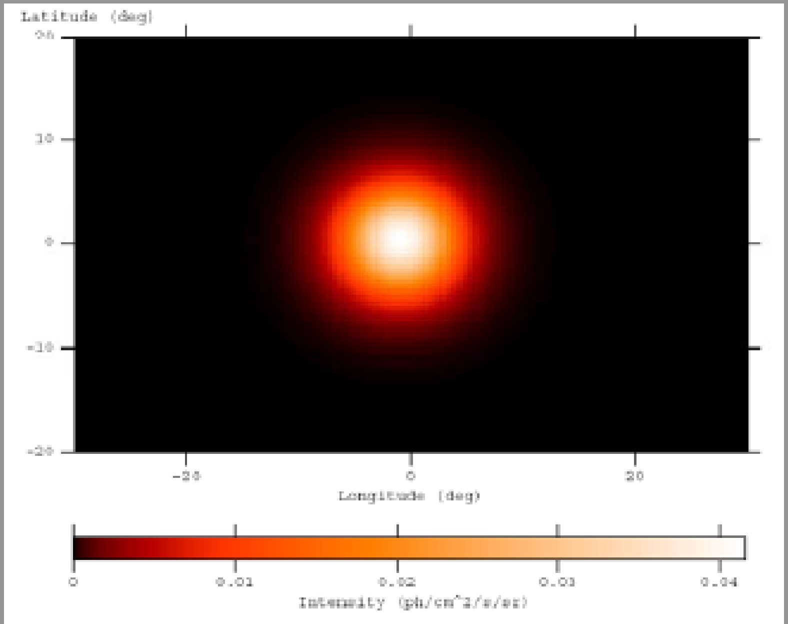
•PAMELA data (August?) should clearly confirm or refute this signal, and measure the spectrum up to much higher energies





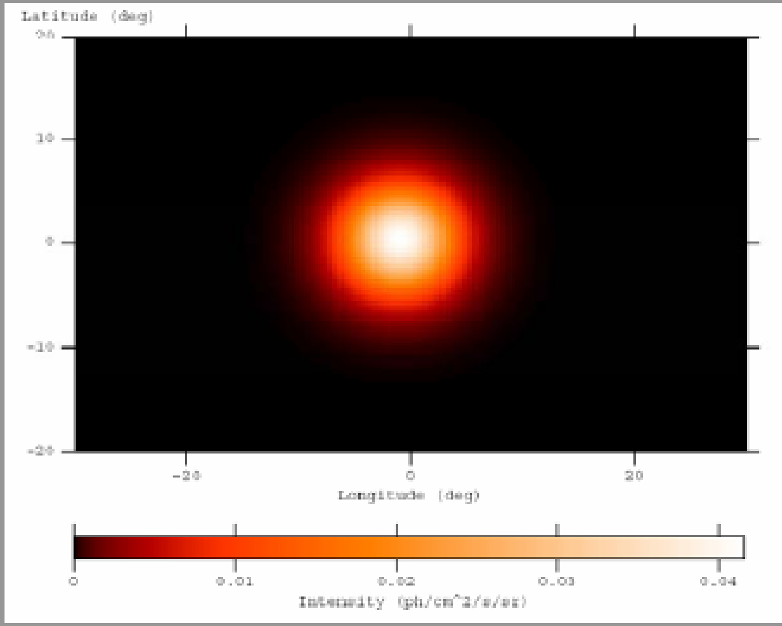
511 keV Emission from the Galactic Bulge

- INTEGRAL/SPI observed bright 511 keV emission from the bulge of the Milky Way (1.3 x 10^{43} positrons injected per second)
- Gaussian, spherically symmetric morphology (FWHM of 8°)
- The source of these positrons remains unknown



511 keV Emission from the Galactic Bulge

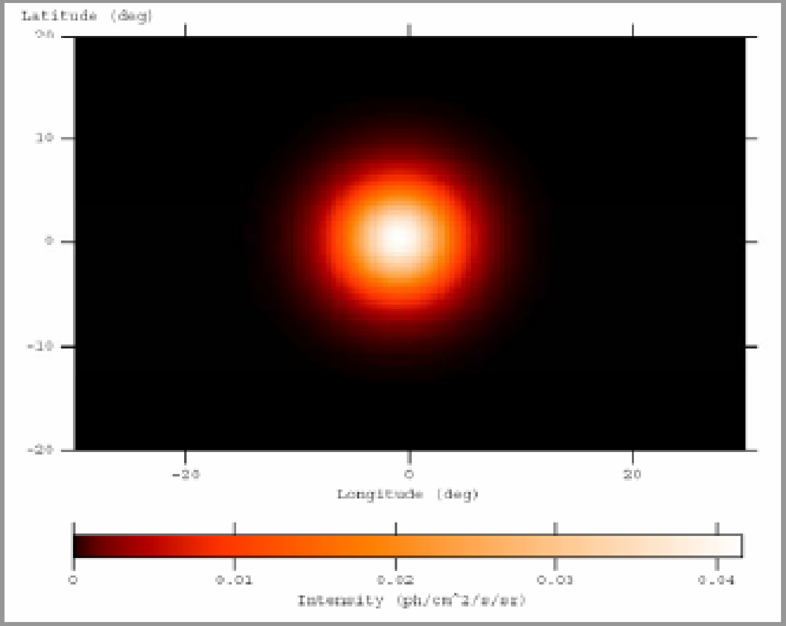
- Type Ia supernovae are unable to generate the observed injection rate (too few escape)
- Hypernovae (type Ic SNe) or gamma ray bursts could potentially generate enough positrons if high estimates for rates are considered
- Even if the injection rate is sufficient, a mechanism is required to transport from disk to bulge - appears difficult



511 keV Emission and MeV Dark Matter

- The INTEGRAL morphology matches well that which would be generated through the annihilation (or decay) of dark matter
- 1-10 MeV dark matter particles annihilating to e^+e^- could simultaneously generate the measured dark matter relic abundance, and the observed 511 keV emission

(Boehm, Hooper, Silk, Casse, Paul, PRL, astro-ph/0309686)



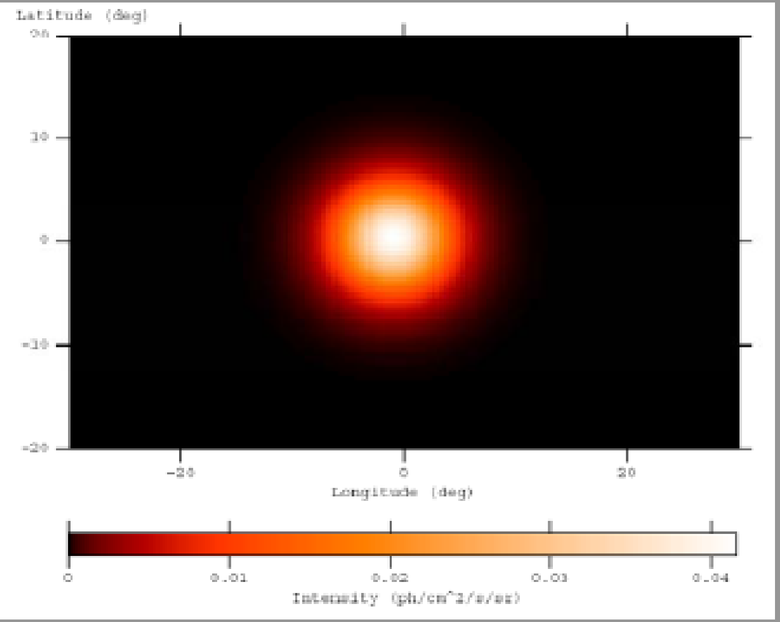
511 keV Emission and MeV Dark Matter

Strengths:

•Challenging to explain 511 signal with non-exotic astrophysics

Weaknesses:

•Somewhat difficult to construct a viable particle physics model with an MeV WIMP



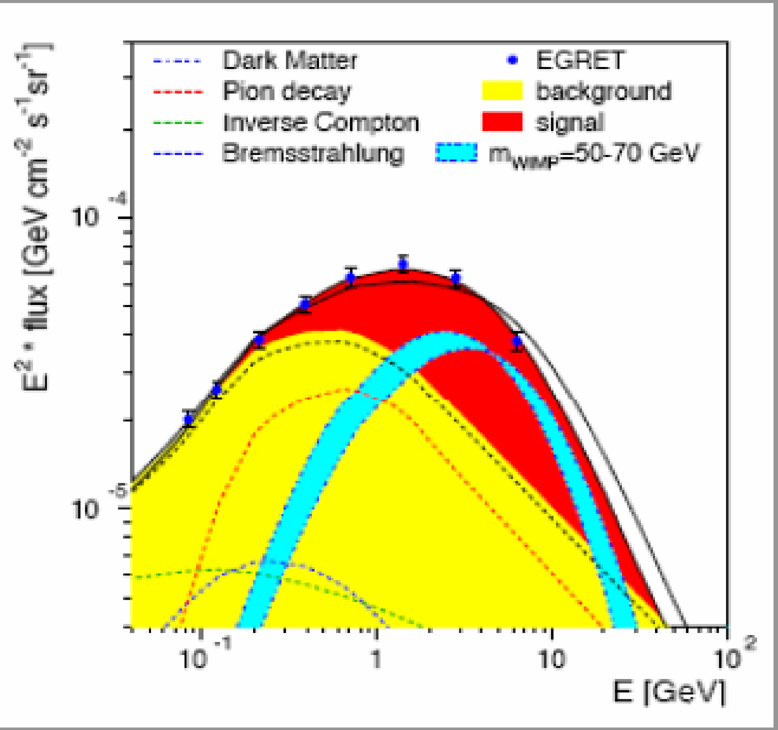
Prospects:

•No clear path to confirmation or exclusion of the MeV dark matter hypothesis (perhaps 511 emission from dwarf galaxies?)

EGRET's Galactic Gamma Ray Spectrum

- EGRET observed an excess of gamma rays above 1 GeV, compared to the the most simple galactic cosmic ray models

- Coud be the product of a ~50-100 GeV WIMP
(W. de Boer et al, PLB, hep-ph/0511154; Astron.Astrophys, astro-ph/0508617; astro-ph/0408272)



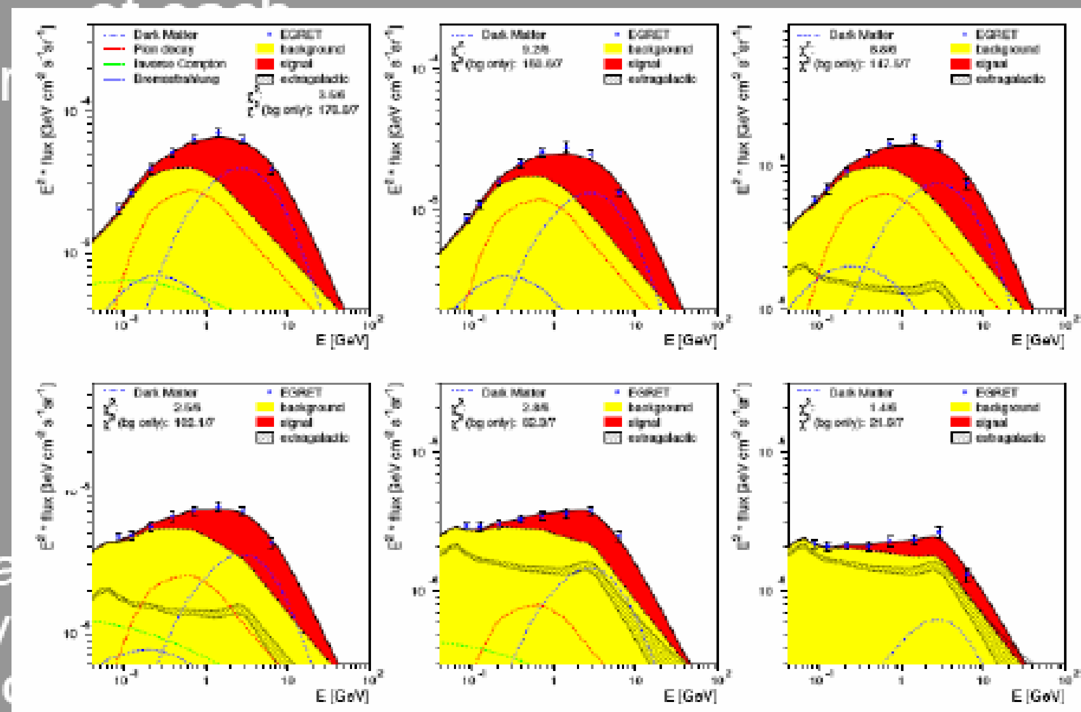
EGRET's Galactic Gamma Ray Spectrum

- The same dark matter annihilation spectrum can fit the shape of the GeV excess in all regions of the sky

Region	Longitude l	Latitude $\|b\|$	Description
A	330-30	0-5	Inner Galaxy
B	30-330	0-5	Disk without inner Galaxy
C	90-270	0-10	Outer Galaxy
D	0-360	10-20	Low longitude
E	0-360	20-60	High longitude
F	0-360	60-90	Galactic Poles

- To normalize the intensity
region, however,
departure from
simple halo profile

- De Boer, et al. introduce two rings of dark matter near the galactic plane at 4 and 14 kpc from galactic
center (8×10^{10} $M_{\odot}$ tida
disrupted dwarf galaxy
motivated by rotation c

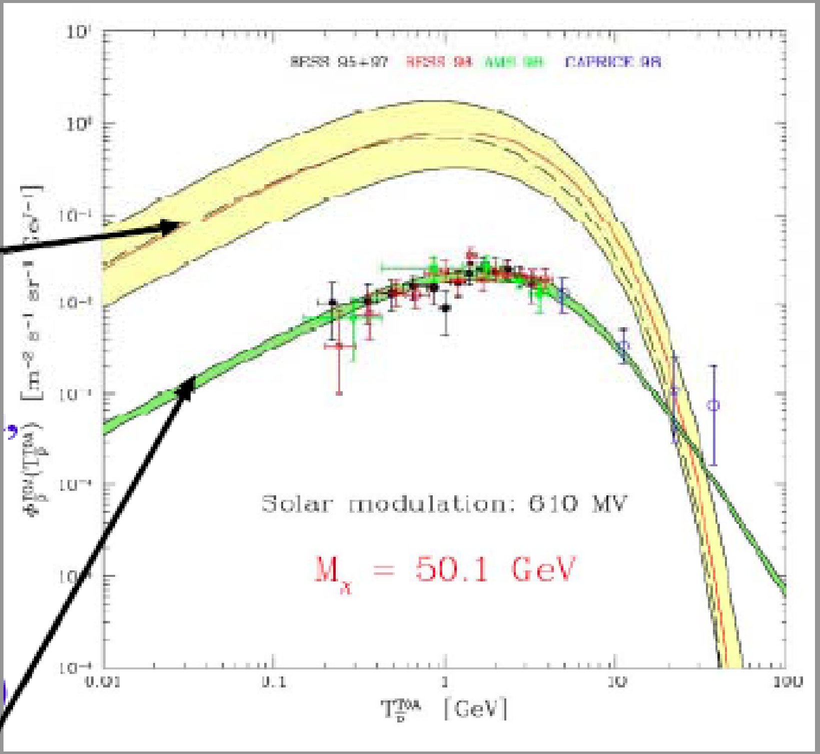


(W. de Boer et al, A.A., astro-ph/0508617)

EGRET's Galactic Gamma Ray Spectrum

- With a standard treatment of cosmic ray diffusion, far too many antiprotons are produced in this scenario
- To reconcile, anisotropic diffusion, strong convection away from (and outside of) the disk and local spatial variations are required (see talk by Iris Gebauer)

Prediced in de Boer model



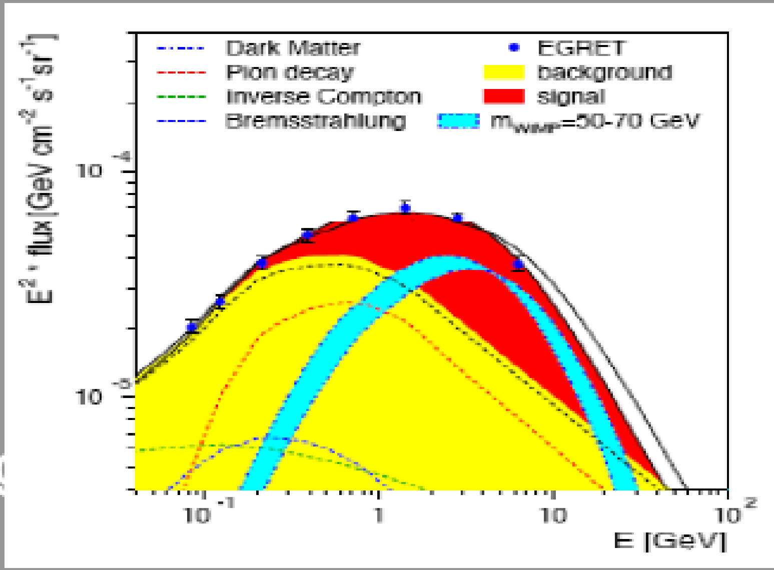
Prediction from standard secondary cosmic ray production

(Bergstrom, Edsjo, Gustafsson and Salati, JCAP, astro-ph/0602632)

EGRET's Galactic Gamma Ray Spectrum

Strengths:

- Consistent with a neutralino or other EW-scale WIMP
- Similar spectral shape over sky



Weaknesses:

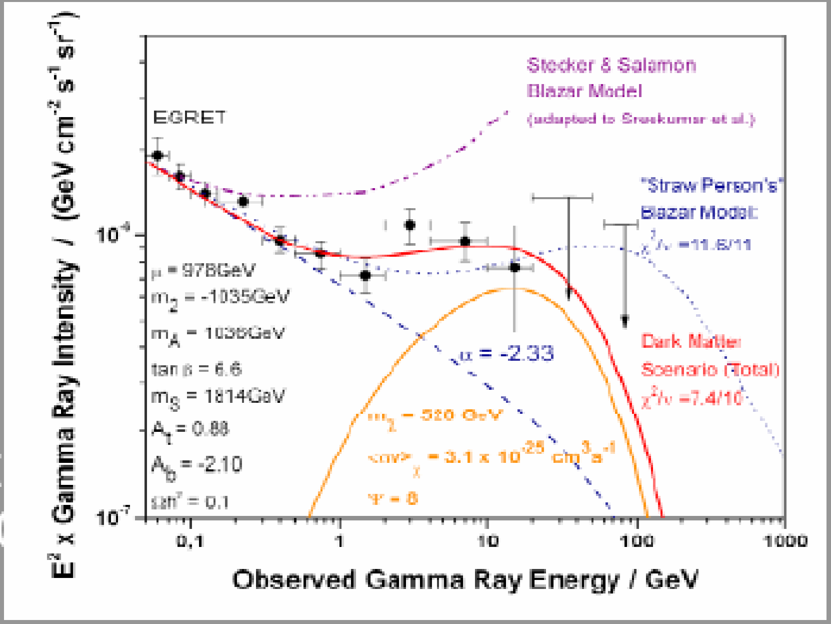
- Non-standard dark matter distribution is needed (two ring
- Conflict with antiprotons unless non-standard comic ray diffusion is invoked
- The GeV excess can plausbily be reduced or eliminated without dark matter by modifying the diffusion model

Prospects: GLAST will clear up these questions considerably

Dan Hooper - *Indirect Searches For Particle Dark Matter*

EGRET's Extragalactic Gamma Ray Spectrum

- EGRET has also detected a diffuse, extragalactic gamma ray signal, which becomes more intense above 1 GeV
- Integrated signal from dark matter annihilations throughout the universe could produce a potentially observable signal (Ullio, Bergstrom,Edsjo 2002)
- Intensity depends critically on dark matter distribution - cuspy halos and substructure are required
- The EGRET extragalactic diffuse spectrum can be fit annihilations from a ~500 (neutralino (or other WIMP)



Dan Hooper - *Indirect Searches For Particle Dark Matter*

Elsasser and Mannheim, PRL, astro-ph/0405235

EGRET's Extragalactic Gamma Ray Spectrum

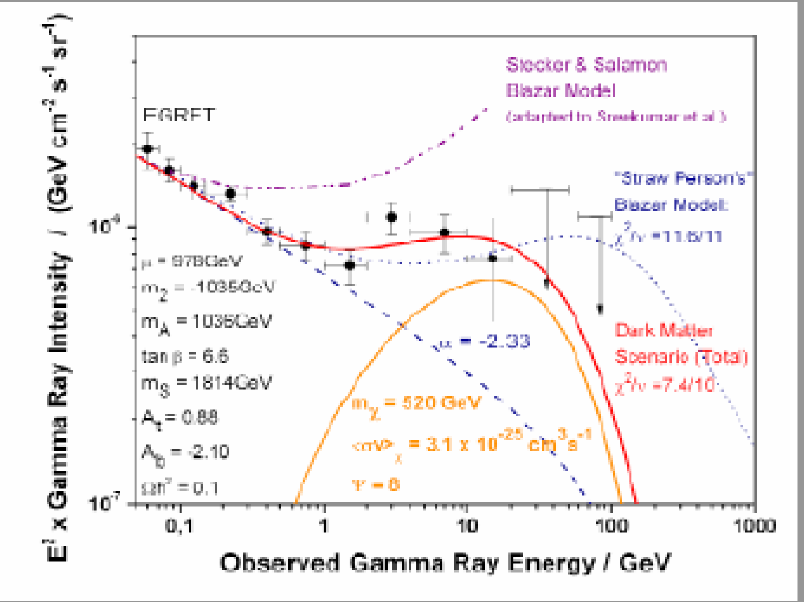
Strengths:

•Consistent with a (somewhat heavy) neutralino or other WIMP

Weaknesses:

•Not a particularly distinctive signal
- could easily be astrophysical

•High annihilation rate needed;
either large degree of very cusped substructure, or a non-thermal



•Signal from our galactic center would have been seen, unless cusp is removed by tidal effects (S. Ando, PRL, astro-ph/0503006)

Prospects: GLAST will clearly resolve

Dan Hooper - *Indirect Searches For Particle Dark Matter*

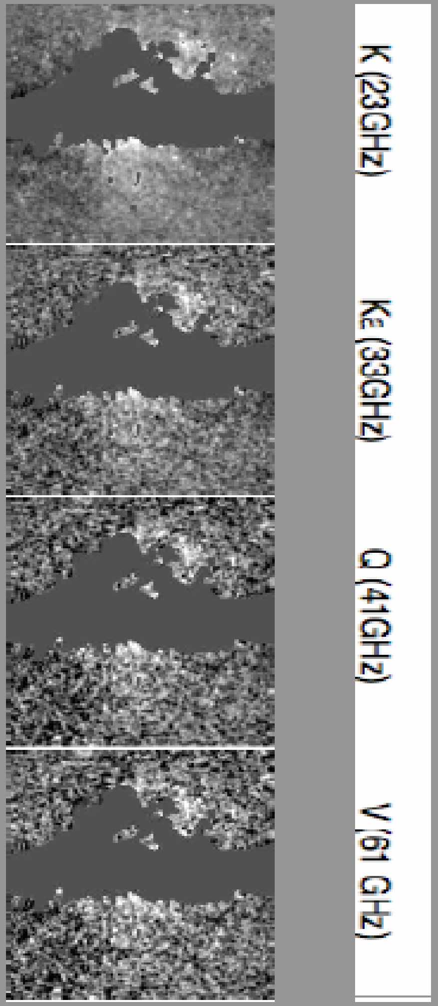
The WMAP Haze

•When known foregrounds are subtracted from the WMAP data, a residual around the Galactic Center remains in all five frequency channels

•Approximate spherical symmetry, 20-30° angular extension

•Initially interpreted as thermal bremsstrahlung (free-free emission) from hot gas, but now ruled out by the lack of corresponding X-ray line

•Possible synchrotron emission from dark matter annihilation products (e^+e^-)

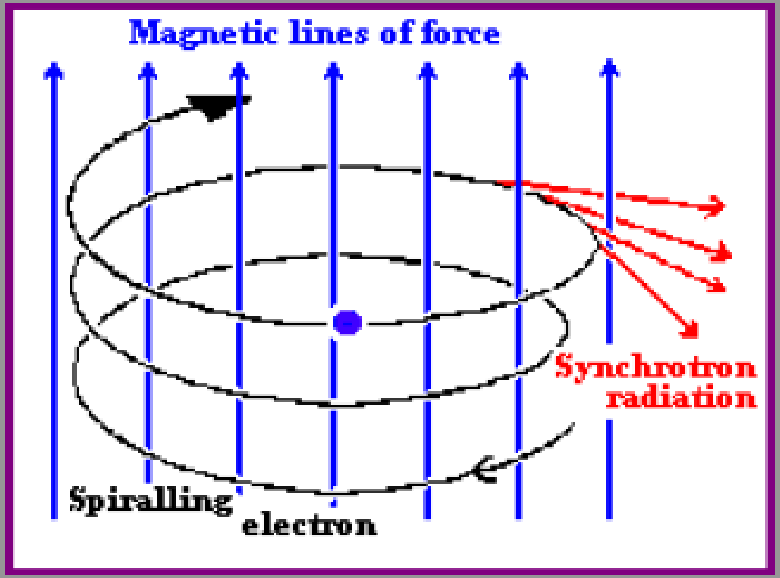


Dan Hooper - *Indirect Searches For Particle Dark Matter*

D. Finkbeiner, astro-ph/0409027; Hooper, G. Dobler, D. Finkbeiner, arXiv:0705.3655

The WMAP Haze

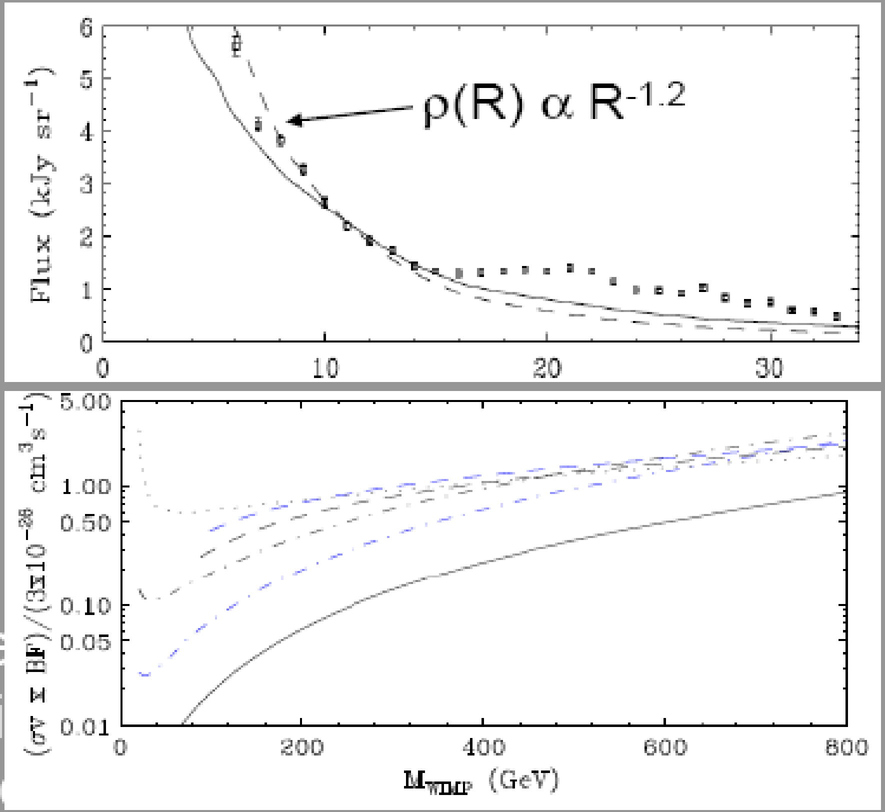
- Electrons/positrons produced in dark matter annihilations will emit synchrotron photons as they propagate through the galactic magnetic fields
- For weak-scale dark matter, the synchrotron radiation falls within the frequency range of WMAP and other CMB experiments



Three Reasons to Think the WMAP Haze is produced by Dark Matter

1) Angular distribution of the haze matches that found for a cusped halo profile, with $\rho \propto R^{-1.2}$

2) Electron/positron spectrum from ~100 GeV to multi-TeV WIMP annihilations is consistent with haze spectrum



3) For 100-1000 GeV WIMP, the annihilation cross section ne to produce the measured i of the haze is within a fact 2-3 of the value needed to generate the density of dark matter thermally (no boost factors are required)

Hooper, G. Dobler and D. Finkbeiner, arXiv:0705.3655

The WMAP Haze

Strengths:

•Data is best fit to a standard electroweak scale, thermally produced WIMP (neutralino, etc.)

•No exotic astrophysics is required - standard cusped halo profile, reasonable magnetic fields, no boost factors, etc.)

Weaknesses:

•Not a particularly distinctive signal - it is hard to rule out all astrophysical possibilities completely

Prospects:

•PLANCK should strongly confirm (or refute) the presence of the WMAP haze

•GLAST should be capable of detecting gamma rays from the galactic center in this scenario