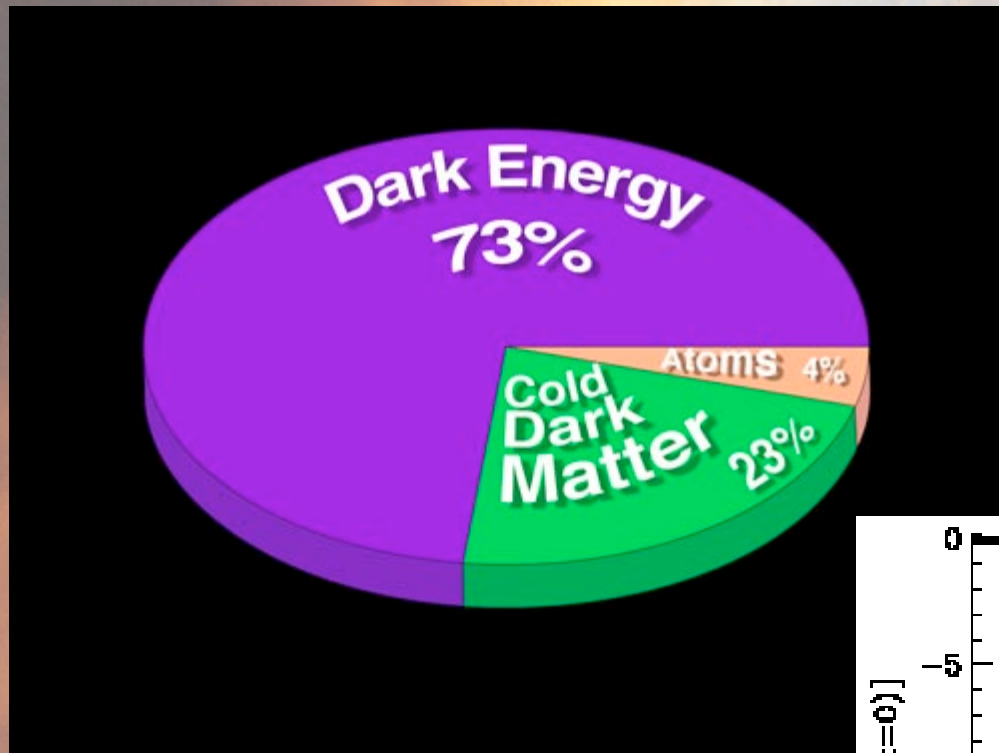


500GeV Neutralinos and Extragalactic Background Radiation

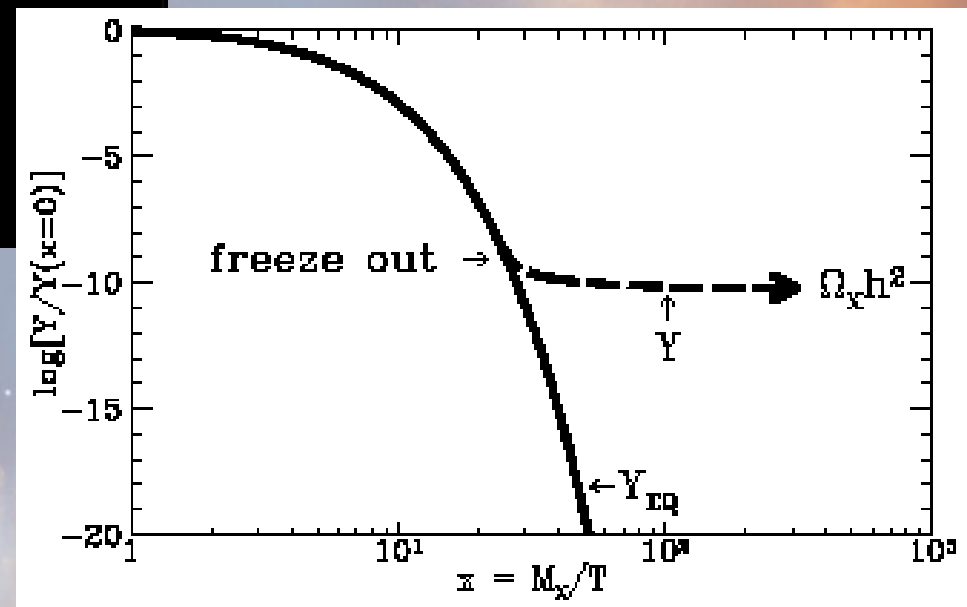
Dominik Elsässer and Karl Mannheim



Composition of the Universe



WMAP Collaboration



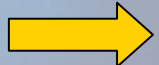
Dark Matter in the Universe


- Rotation curves of spiral galaxies, structure formation, gravitational lensing studies, 3K – background radiation all hint at large amounts of non – luminous matter
- Primordial nucleosynthesis demands non - baryonic constituents
- Whole „zoo“ of candidate particles and objects has been discussed
- SUSY calls for heavy (stable) particle which might well be neutral
- „Neutralinos“ freeze out during hot Big Bang

WMAP

Annihilation of Neutralino CDM

- In many SUSY-scenarios, the neutralino (χ) is the LSP; it can be considered a natural WIMP candidate
- Annihilation – channels into photons:

$\chi \chi \rightarrow q\bar{q}, \tau\bar{\tau}, \dots \rightarrow \text{pions} \rightarrow \gamma\gamma$  **Continuum**

$\chi \chi \rightarrow Z_0 \gamma$  **Line emission** Loop suppressed

$\chi \chi \rightarrow \gamma\gamma$

- SUSY-induced gamma ray flux:

$$\Phi_\gamma(\varepsilon) = \frac{1}{4\pi} \times \frac{\frac{1}{2} \langle \sigma v \rangle}{m_\chi^2} \times \int \rho_\chi^2 \times df[\varepsilon(1+z)] ds$$

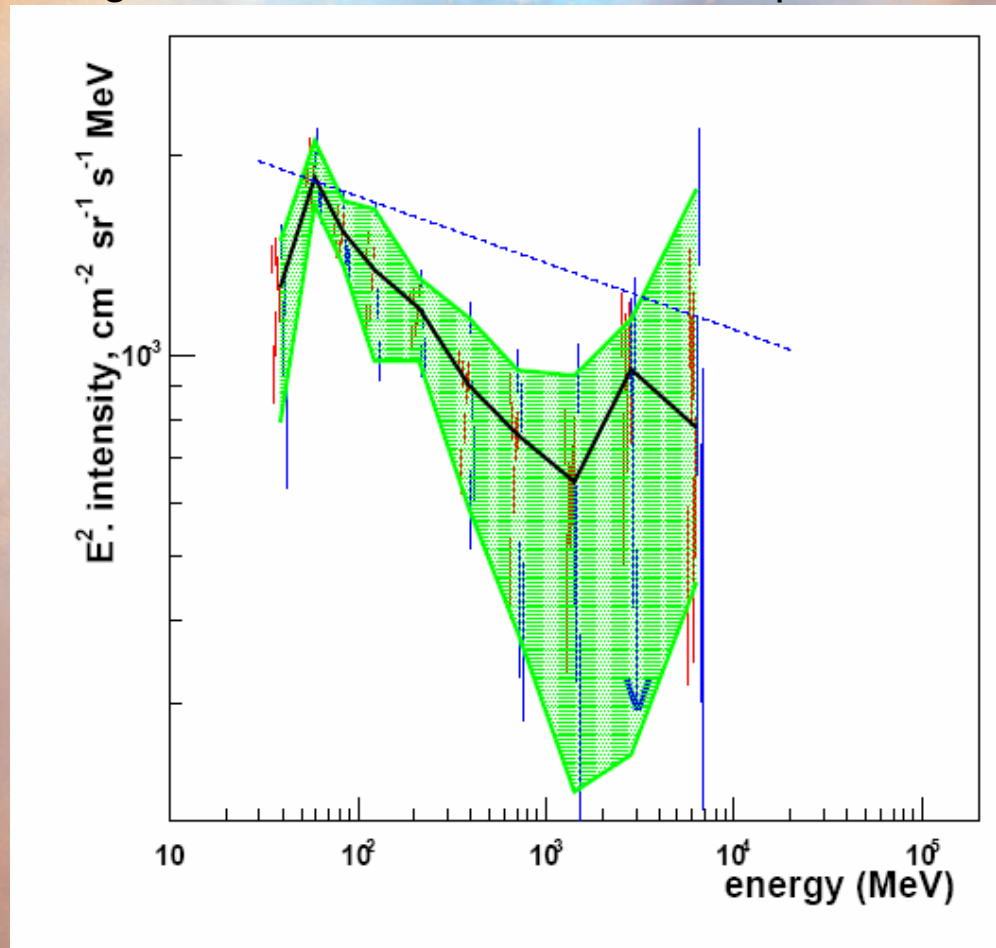
- SUSY-setup and halo parameters determine the flux; presently, both are subject to huge uncertainties (e.g. influence of substructure, cusiness, adiabatic compression!)
- Knowledge of astrophysical/instrumental backgrounds is essential

Extragalactic Gamma Background

- Sreekumar et al., 1998: (fairly) featureless power law (-2.1)
- Different source populations (blazars, gamma ray bursts, galaxy clusters...) have been discussed
- Strong et al. determination shows challenging differences!
- Multi – GeV „bump“ might be a signature of neutralino annihilation!

A new determination of the EGRET EGB

Strong, Moskalenko & Reimer, astro-ph/0405275



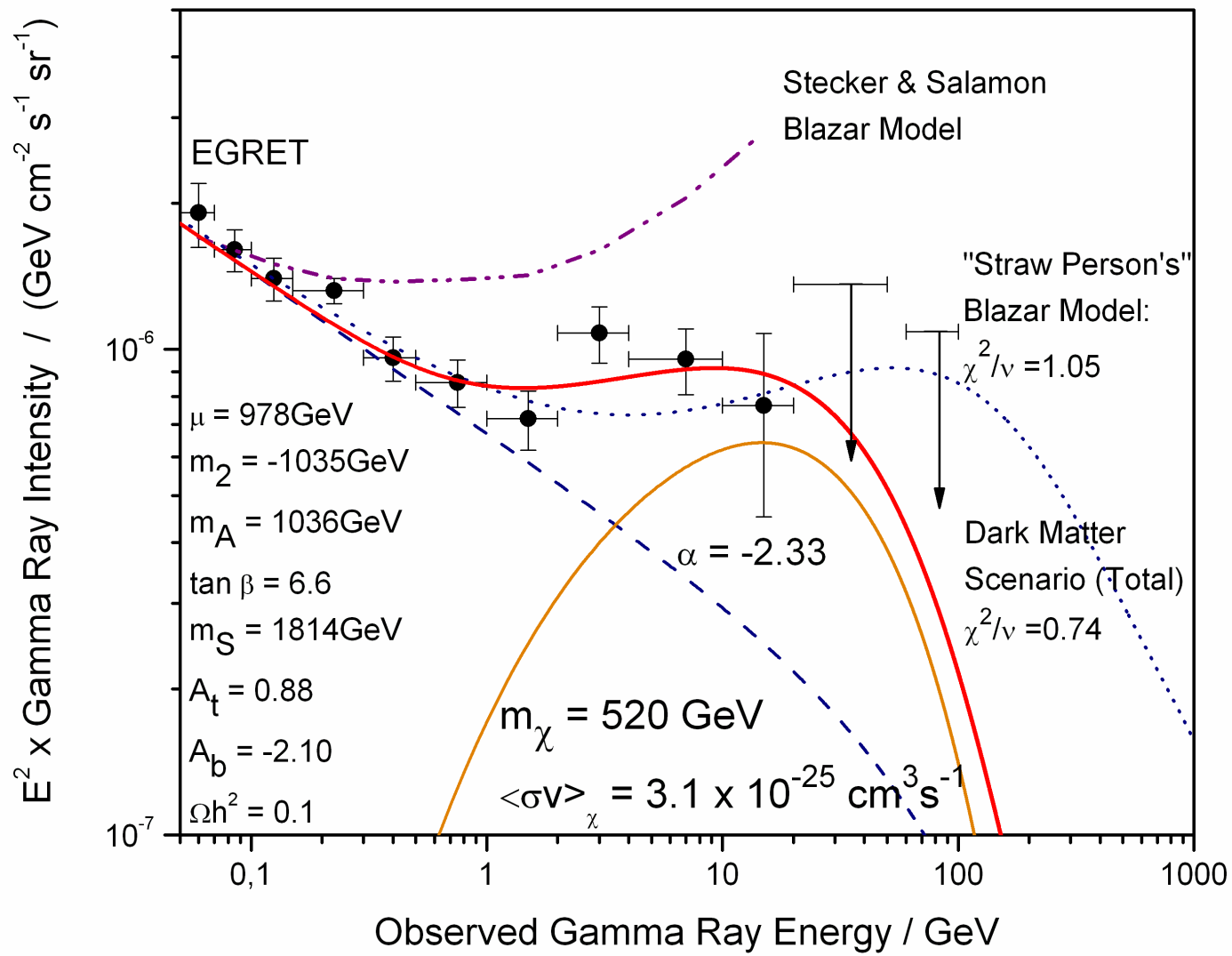
EGB from DM - Annihilation

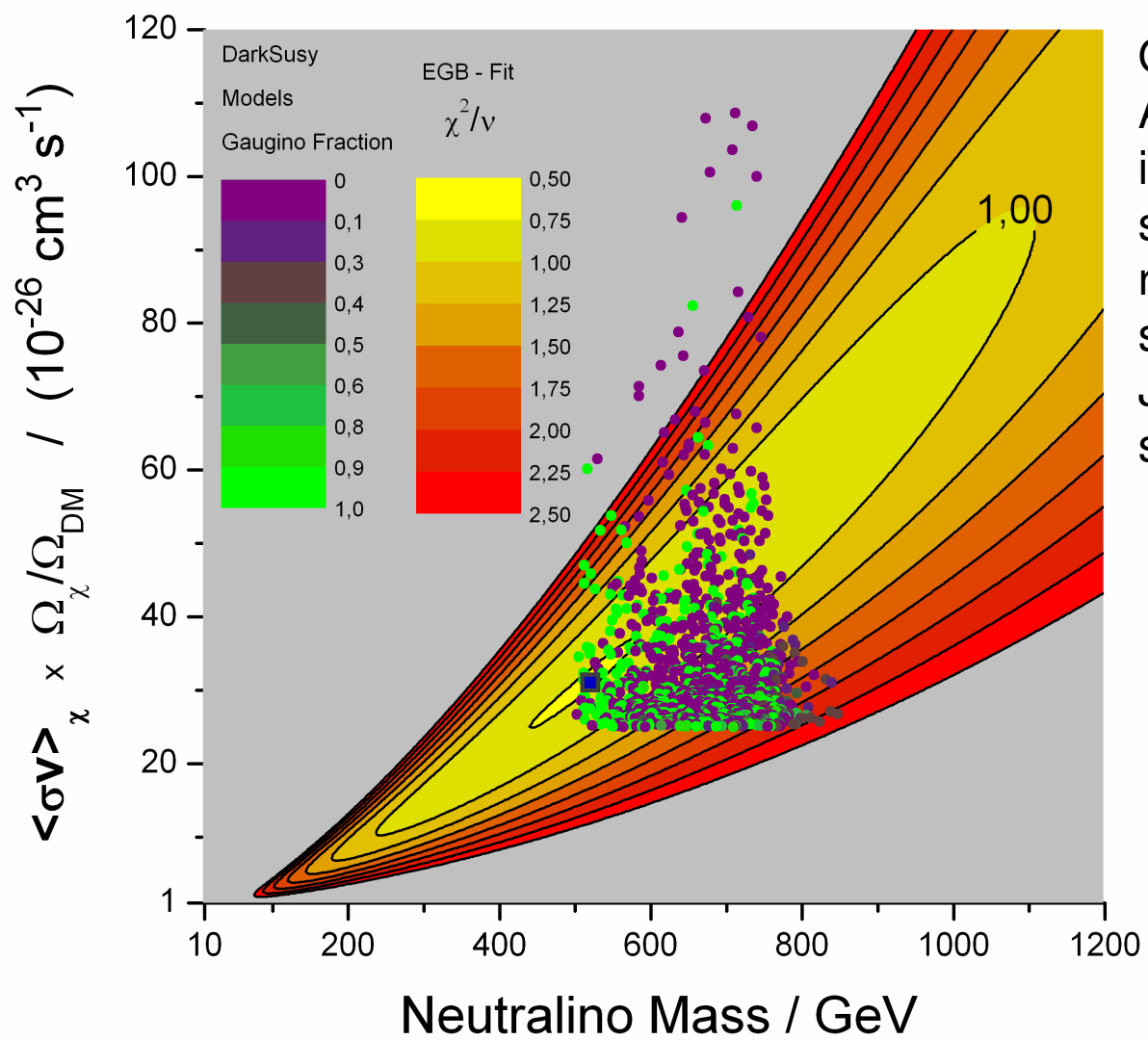
- Solve Boltzmann – Equation
- Account for redshift evolution, structure formation, gamma attenuation and annihilation spectrum

$$\Phi_{\gamma}^{\text{Neutralino}}(\varepsilon) = \frac{c}{4\pi H_0} \times \frac{\frac{1}{2} \langle \sigma v \rangle \Omega_{\text{DM}}^2 \rho_{\text{crit}}^2}{m_{\chi}^2} \times \int_0^{z_{\text{max}}} dz \frac{(1+z)^3 \times \kappa[\varepsilon(1+z), z] \times \Gamma(z)}{h(z)} \times df(\varepsilon(1+z)).$$

D. Elsässer & K. Mannheim, *Astropart. Phys.* **22**/1, pp. 65 - 72

D. Elsässer & K. Mannheim, astro-ph/0405235

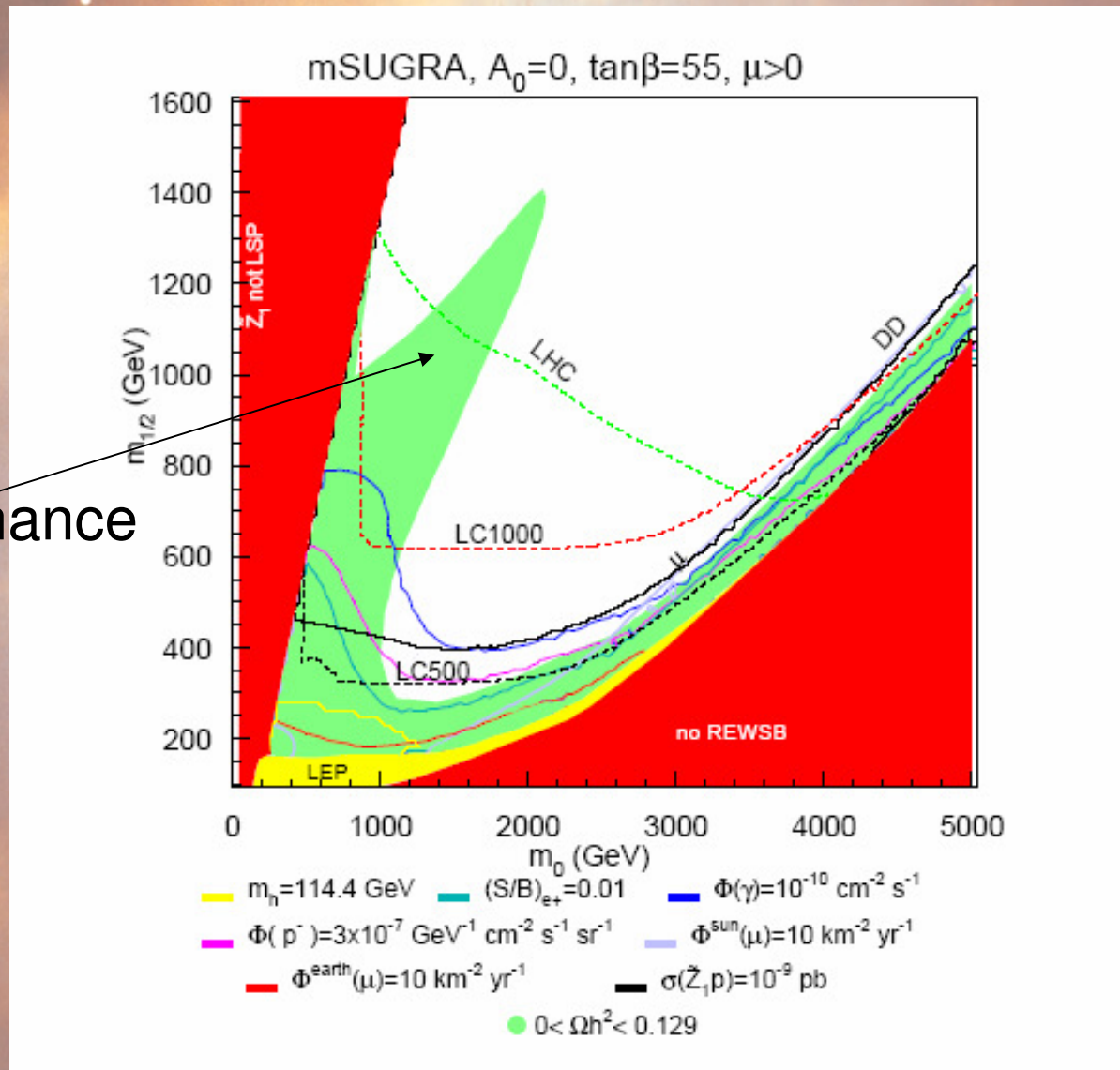




On a sidenote:
 Also Li6 – excess
 in metal-poor
 stars might be
 reproduced by
 such a model (K.
 Jedamczik, JCAP
 submitted)

mSugra: Where do we reside?

m_A – resonance
„funnel“



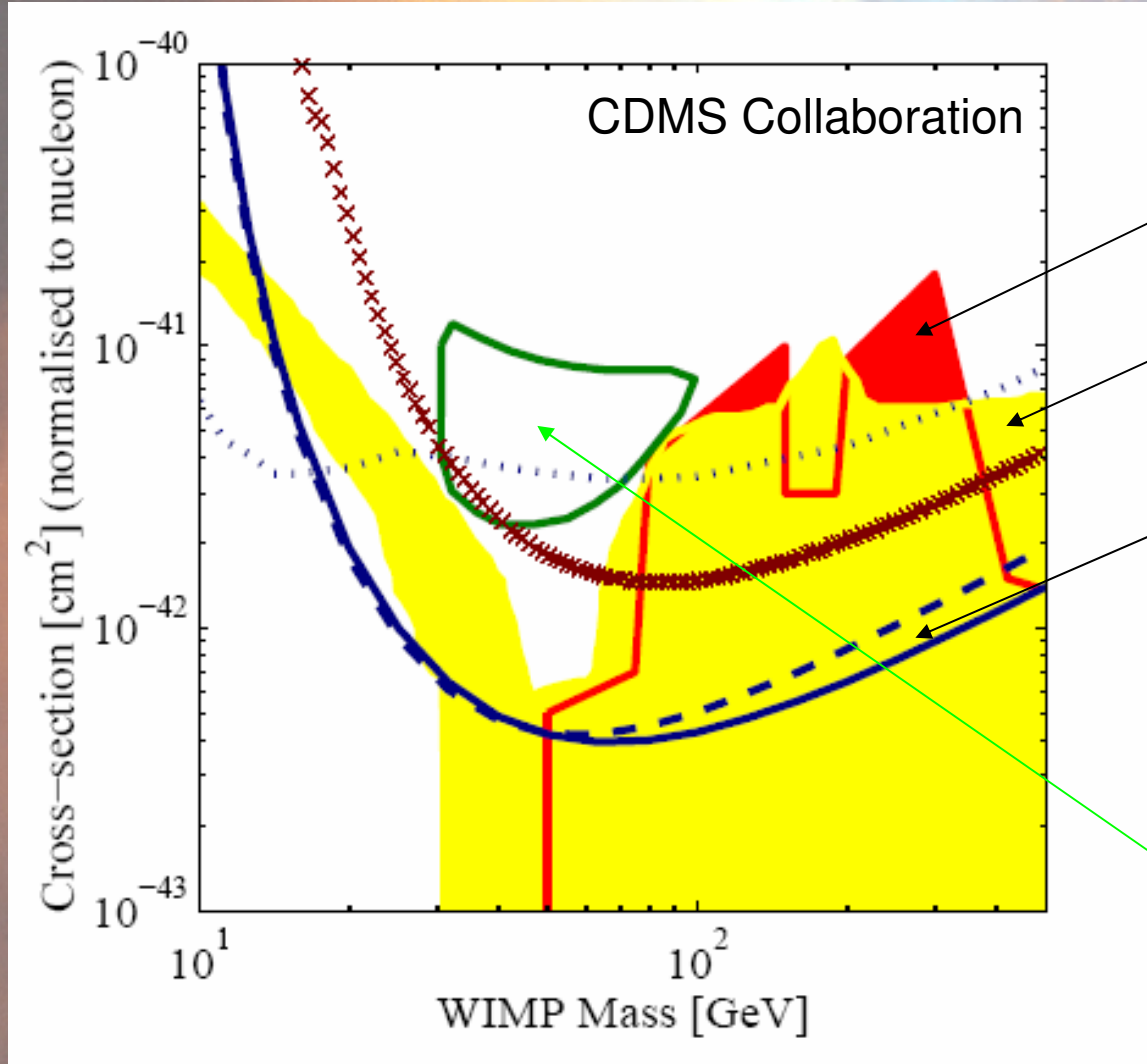
Mass Spectrum (GeV)

- h1 1036.657349
- h2 118.319801 ←
- a 1036.228600 Light Higgs;
- h+ 1039.220215 should show up at LHC
- gluino 3591.233676
- x0_1 520.081698
- x0_2 952.219632 ←
- x0_3 980.738794
- x0_4 1063.452719 NLSP neutral and heavy;
- x+_1 1063.696665 not good for
- x+_2 952.836728 accelerator searches
- s-nu_1 1813.104637

Conclusions

- Spectral shape of the EGB might well be the long – sought first signature of supersymmetric Dark Matter
- Also possibly interesting signatures from neutrino, antiproton and positron channels
- Stay tuned for TESLA, LHC, MAGIC, H.E.S.S., VERITAS and GLAST!

Direct Dark Matter Searches



$g_{\mu-2}$ – favoured region

mSugra MonteCarlo

CDMS II
exclusion limits

DAMA excluded at
99% C.L.!

Extragalactic Neutrino Background

D. Elsässer & K. Mannheim, *Astropart. Phys.* **22**/1, pp. 65 - 72

