The gamma ray fluxes from neutralino annihilations in the Galactic Centre with AMS

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Abstract

Under the assumption that the dark matter is composed of the lightest, stable supersymmetric particle, assumed to be the neutralino, the feasibility of its indirect detection via observations of a contineous gamma-ray signal due to neutralino annihilations within Galactic Centre is examined. The results of the simulations in the frame of mSUGRA models show that under favorable astrophysical conditions such as a cuspy dark matter profile or the accretion of neutralinos on the central black hole or the presence of many clumps inside its halo, a neutralino annihilation gamma-ray signal could be detectable in one year observation of AMS.

(preliminary version)

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1 Introduction

The existence of cosmic dark matter is required by a multitude of observations and arguments, such as the excessive peculiar velocities of galaxies within clusters of galaxies, or gravitational arcs indicating much deeper gravitational potentials within clusters than those inferred to be present from only the luminous matter content. Also an epoch of Big Bang nucleosynthesis predicts a fractional contribution of baryons to the critical density, Ω_b, significantly smaller than the total Ω in form of clumpy matter. On the galactic scale, the rotation curves need dark matter halos when fitting their parametrization as a function of the distance of the luminous matter in the spiral galaxies, or the velocity dispersion in the elliptical ones.

The nature of the dark matter is one of the outstanding problems and challenges in cosmology. Virtually all proposed candidates require physics beyond the standard model of particle physics. A candidate particularly well-suited to the formation of the observed large-scale structure, is a weakly interacting particle with comparatively small velocities before the onset of structure formation (i.e. Cold Dark Matter, herafter CDM) [1, 2]. An overview of the n-body simulation results related to CDM issues can be found in [3]. The lightest stable neutralino (LSP) is a favoured candidate of the R-parity conserving SUSY theory with mass between 50 GeV and 1 TeV and velocity values about 200 km/s. We will concentrate here on the gamma flux predictions from neutralino annihilations in the frame of mSUGRA models.

2 The neutralino halo around Galactic Centre

2.1 The dark matter halo parametrization

For a spherical halo the mass density profile is generically given by

$$\rho_\chi(r) \;=\; \rho_0 \left(\frac{R_0}{r}\right)^\gamma \left\{\frac{R_0^\alpha + a^\alpha}{r^\alpha + a^\alpha}\right\}^\epsilon \quad . \tag{1}$$

A cored isothermal profile with core radius a corresponds to $\gamma = 0$, $\alpha = 2$ and $\epsilon = 1$. A NFW profile [4] is obtained with $\gamma = 1$, $\alpha = 1$, and $\epsilon = 2$, whereas Moore's distribution [5] is recovered if $\gamma = \epsilon = 3/2$ and $\alpha = 1$. The NFW model and Moore model describing the halo around Galactic Centre (GC) are considered in this study. These two models predict large values of the neutralino density in the Galactic Centre.

The parameters that enter the halo modelling are:

- R_0 - distance from Earth to GC,
- ρ_0 - halo density at the R_0,
- a - core radius - for $r < a$ halo density is equal to $\rho(a)$ to avoid singularity in case of the isothermal parametrization.

As shown in [6] ρ_0 and a cannot be chosen arbitrarly. The assumption of the total mass of the Galaxy restricts the (ρ_0, a) parameter space. For the NFW model the generic parameter values are: $R_0 = 8.0\ kpc$, $\rho_0 = 0.3\ GeV/cm^3$, $a = 20\ kpc$. As shown in [7], the (ρ_0, a) parameters can been chosen to get the high value of the photon flux: $R_0 = 8.5\ kpc$, $\rho_0 = 0.4\ GeV/cm^3$, $a = 4\ kpc$. These two configurations will be denoted as NFW(std) and NFW(max). The values for Moore profile have been chosen in a conservative way: $R_0 = 8.0\ kpc$, $\rho_0 = 0.3\ GeV/cm^3$, $a = 28\ kpc$.

The neutralinos potentially concealed around GC should annihilate and produce high-energy photons. The corresponding flux at Earth, n_γ – per unit of time, surface, and solid angle – may be expressed as

$$\frac{dn_\gamma}{dt\,dS\,d\Omega} = \frac{1}{4\pi}\frac{\langle\sigma v\rangle\,N_\gamma}{m_\chi^2}\int_{\rm los}\rho_\chi^2\,ds = \frac{1}{4\pi}\frac{\langle\sigma v\rangle\,N_\gamma}{m_\chi^2}\,\mathcal{J}(R) \tag{2}$$

where m_χ is the neutralino mass and $\langle\sigma v\rangle\,N_\gamma$ denotes the thermally averaged annihilation rate yielding N_γ gamma-rays in the final state. The astrophysical part of the expression consists in the integral $\mathcal{J}$ along the line of sight of the neutralino density squared ρ_χ^2. Assuming a spherical halo with radial extension R_0 leads to

$$\mathcal{J}(R) = 2\int_0^{\sqrt{R_0^2-R^2}} \rho^2\left(\sqrt{s^2+R^2}\right)\,ds\ , \tag{3}$$

for a direction with impact parameter R off the centre of the Galaxy. Because the density decreases steeply at large distances (see Eq. 1), our results are not sensitive to the actual value of the radial cut-off R_0 which was set to 8.5 kpc. The next step is the sum of the line of sight integral $\mathcal{J}$ over the solid angle subtended by the source and the detector

$$\Sigma = \int \mathcal{J}(R)\,d\Omega\ . \tag{4}$$

We are interested in the number I_γ of high-energy photons – collected per unit of time and surface – that originate from a circular region with angular radius $\theta_{\rm obs}$. The previous expression simplifies into

$$\Sigma = 2\pi\int_0^{\theta_{\rm obs}} \mathcal{J}(R)\ \sin\theta\ d\theta\ , \tag{5}$$

where $R/R_0 = \tan\theta \simeq \theta$ and $R_0 \sim 8.5$ kpc is the distance to GC. Integrating relation (2) over the source leads to the gamma-ray signal

$$I_\gamma \;=\; \left(1.87\times 10^{-11}\ \text{photons cm}^{-2}\ \text{s}^{-1}\right) \left\{\frac{\langle\sigma v\rangle\, N_\gamma}{10^{-29}\ \text{cm}^3\ \text{s}^{-1}}\right\} \left\{\frac{10\ \text{GeV}}{m_\chi}\right\}^2 \Sigma_{19} \;\;, \qquad (6)$$

where Σ_{19} denotes Σ expressed in units of 10^{19} GeV^2 cm^{-5}.

2.2 Impact of the astrophysical parameters

Two astrophysical factors may enhance the expected gamma fluxes from the neutralino annihilations:

- clumpiness of the dark matter halo as shown by the n-body simulations [3],
- presence of the Supermassive Black Hole (SBH) of a mass of $\sim 2.6\times 10^6\ M_\odot$ accreting neutralinos around GC.

The global enhancement factor on expected flux has been estimated in [8]. It may vary between 5 and 100, depending on the clumpiness of the galactic halo and the CDM-accreting SBH.

3 Supersymmetric model predictions

Here we concentrate on more specific particle physics model predictions of the γ - ray fluxes. The aim is to use a computational tool which allows to scan over various observables related to supersymmetric dark matter. This is achieved through an interfacing of two public codes, DarkSUSY [9] and SUSPECT [10], which we dub hereafter DSS (DarkSUSY-SUSPECT). Significant features on both particle physics and cosmology sides are thus combined within our approach.

3.1 mSUGRA parameterization

The models considered in this work belong to the minimal supergravity scenario mSUGRA where the soft breaking of supersymmetry (SSB) occurs in a hidden sector, which communicates with the visible sector only via gravitational interactions, and translates to the observable particle physics sector in the form of soft masses and trilinear couplings among the scalar fields as well as mass terms in the gaugino sector [11].

$$m^2_{\tilde{Q}} = m^2_{\tilde{U}} = m^2_{\tilde{D}} = m^2_{\tilde{L}} = m^2_{\tilde{E}} = m^2_{\tilde{H}_1} = m^2_{\tilde{H}_2} \equiv m_0^2,$$

the common SSB gaugino mass

$$M_1 = M_2 = M_3 \equiv m_{1/2},$$

the common SSB trilinear coupling

$$A_t = A_b = A_\tau \equiv A_0$$

and unified gauge couplings $\alpha_1 = \alpha_2 = \alpha_3 \equiv \alpha_{GUT}$, all taken at the GUT scale. The relevant low energy quantities are obtained from the renormalization group evolution of these parameters from M_{GUT} down to a scale of the order of the electroweak scale. At this scale electroweak symmetry breaking is required through the minimization equations [13],

$$\frac{1}{2}M_Z^2 = \frac{\bar{m}_1^2 - \tan^2(\beta)\bar{m}_2^2}{\tan^2(\beta) - 1} \tag{7}$$

$$\sin 2\beta = \frac{2B\mu}{\bar{m}_1^2 + \bar{m}_2^2} \tag{8}$$

where $\bar{m}_i^2 \equiv m^2_{H_i} + \mu^2 +$ radiative corrections, μ is the supersymmetric mixing parameter of the two higgs doublets superfields and B is the corresponding SSB parameter in the higgs potential. For a given $\tan\beta$ at the electroweak scale (defined as the ratio of the two Higgs vacuum expectation values $< H_2^0 > / < H_1^0 >$), one determines from the above equations the μ parameter (up to a sign ambiguity) and the B parameter consistent with the physical value of the Z boson mass M_Z. In SUSPECT [10] the procedure is carried out including radiative corrections to the above EWSB conditions, renormalization group evolution to 1-loop order for the soft parameters, and to 2-loop order for gauge and Yukawa couplings (including threshold corrections from the supersymmetric spectrum). The full MSSM mass spectrum and couplings are computed and fed to DarkSUSY [9].

Various phenomenological constraints are taken into account (e.g. consistency with top, bottom and τ masses, present experimental limits on superpartner and Higgs masses, limits from bottom decay $b \to s\gamma$, no charged LSP, ...), some of which are implemented in SUSPECT and others in DarkSUSY[2].

[2] where we have disactivated the $g_\mu - 2$ constraint.

We consider configurations motivated by the focus point behaviour within mSUGRA [12]. This allows in principle large m_0 values (in the TeV range) without having to fine-tune the parameters in Eq.(7). This comes about due to a peculiar behaviour in the running of $m^2_{H_2}$ from the GUT scale to the electroweak scale, which renders this soft mass fairly insensitive to the supersymmetry parameters provided that $\tan\beta$ is moderate or large. The implication for neutralino dark matter can be important as the LSP would acquire a non negligible higgsino component (in contrast to the generic mSUGRA almost purely bino prediction). This would affect the relic density as well as the gamma fluxes from LSP annihilation into W or Z pairs, when kinematically allowed, are no more suppressed as compared to the fermion-anti-fermion channels. Nonetheless, the "naturalness" of the focus point is actually moderated by a high sensitivity to the top quark mass in relic density calculations [16]. We will thus adopt hereafter a qualitative standpoint where m_0 is allowed to be in the TeV range, disregarding fine-tuning issues.

3.2 mSUGRA results

The DSS program will provide values of γ fluxes for the SUSY benchmark models [18, 19] and the so-called "wild scan" configurations of the mSUGRA parameters.

3.2.1 Benchmark point simulations

The SUSY benchmark models have been proposed by [18, 19] to provide a common way of comparing the SUSY discovery potential of the future accelerators such as LHC or Linear Colliders. The thirteen SUSY scenarios correspond to thirteen configurations of the five mSUGRA parameters with the trilinear coupling parameter A_0 set to 0. The models fulfill the conditions imposed by LEP measurements, the $g_\mu - 2$ result (which in our case will be not fulfilled), and the relic density constraint: $0.1 < \Omega_\chi h^2 < 0.3$.

To derive the gamma ray fluxes for some of these benchmark models we will use our current MC simulation programs: DarkSUSY [9] and SUSPECT [10], which were described previously. The value of $\Omega_\chi h^2$ is calculated in the DarkSUSY part where only $\chi^+\chi^0_2$ co-annihilations and annihilations related to the Higgs sector channels are included. As a consequence of these software limitations, the physically accessible SUSY domain in this study corresponds to models B,C,G,I and L of [18, 19]. The simultaneous use of the SUSPECT and DarkSUSY package allows to perform RGE evolution from the GUT scale

Clearly a more refined treatment should require consistency with the standard model predictions [14]. Furthermore, absence of charge and/or color breaking minima is not checked within our (exploratory) approach [15]

Table 1: benchmark models in various simulation.

model	B	C	G	I	L
$m_{1/2}$	255	408	383	358	462
m_0	102	93	125	188	326
$tan\beta$	10	10	20	35	45
sign(μ)	+	+	+	+	+
EWSB scale [GeV]	492.8	721.2	719.1	657.4	836.1
GUT scale [GeV]	2.17×10^{16}	0.30×10^{16}	1.90×10^{16}	1.99×10^{16}	1.86×10^{16}
m_{χ^0}	99.4	162.3	155.1	144.8	190.2
R_g	0.968	0.988	0.987	0.985	0.990
μ	351.5	542.5	500.0	479.2	593.7
m_A	395.8	603.9	545.4	472.4	548.4
M_1	103.6	166.0	158.5	147.7	193.1
M_2	194.7	308.0	295.4	276.0	358.6
M_3	622.7	929.2	900.3	849.6	1071.
$m_{\tilde{q}}$	537.8	787.0	767.2	718.7	907.9

to EWSB scale. Table 1 presents the initial GUT scale parameter values as well as other input parameters to DarkSUSY, calculated by SUSPECT (μ, M_1, M_2, M_3, $m_{\tilde{q}}$, m_A). The GUT scale and EWSB scale values are also quoted as well as neutralino mass and gaugino fraction, R_g.

Table 2 presents the resulting relic density values with different theoretical assumptions corresponding to mSUGRA as described in section 3.1 whereas Table 3 gives results for γ-ray flux, Φ_γ respectively. In order to be free from the Galactic Centre halo modelling, a renormalisation factor on the astrophysical part of the γ flux computation has been applied. This allows a meaningful comparison between our results and those of [18, 19].

Table 2: the relic neutralino density, i.e. $\Omega_\chi h^2$, as obtained in our simulations assuming a bottom mass of $m_b = 4.61\ GeV$ and neglecting radiative corrections.

model	B	C	G	I	L
DSS	0.19	0.32	0.29	0.18	0.10
paper [18]	0.18	0.14	0.16	0.16	0.21

Table 3: the predicted γ-ray flux in units of $10^{-12} cm^{-2} s^{-1}$ from the galactic center for γ-rays with energy $E_\gamma > 1\ GeV$ emanating from GC within a solid angle $\Theta = 10^{-3}\ sr$.

model	B	C	G	I	L
G.C. NFW standard	293.0	30.9	209.1	1442.0	2458.2
G.C. NFW max	12046	1275	8593	59284	101055
G.C. Moore	25355	2683	18086	124785	212705
paper [18]	84.29	10.19	63.90	535.0	992.4
paper [18] renormalized	204.8	24.76	155.3	1300	2412

As far as benchmark points with large $\tan\beta$ are concerned, the relic density is very sensitive to the input bottom mass since the latter controls the position of the s-channel CP-odd Higgs exchange pole [17].

The results in table 2 and 3 obtained here are also compared to those in [18], where a different mSUGRA MC has been used and a more complete set of co-annihilation channels has been included. The observed differences on flux predictions renormalized to the same astrophysical conditions of at most $\sim 25\%$ between our results and those in [18] may well be explained by different treatments of the fragmentation processes with π^0 in the final state.

3.2.2 The AMS detection capabilities

The AMS sensitivity to high-energy gamma-ray sky has been studied through detailed Monte Carlo simulations. To detect photons in the AMS experiment two complementary methods are possible. The first method or *conversion mode* consists in the identification and reconstruction of e^+e^- pairs from photons converting somewhere in the material upstream of the first silicon tracker layer [20][21]. The second method or *single photon mode* is based on the detection of photons in the electromagnetic calorimeter (ECAL)[22]. The AMS detector geometry and performance have been simulated with the dedicated AMS simulation and reconstruction program, based on GEANT package. The simulated performance of the AMS sub-detectors have been checked against the test flight data of the prototype AMS-01 experiment and the test beam data, in particular for detectors which were not present in AMS-01, *e.g.* ECAL. The main figures of merit derived from this study are: average acceptance, effective area, angular resolution, energy resolution, background rejection and their own dependencies on the photons' energy. These parameters are then used to deduce the AMS sensitivity to some specific scientific cases, among which the high-energy γ signal due to neutralino annihilation within the Galactic Center. For such a specific case, as first approximation we have assumed the GC as pointlike γ source located at galactic longitude l=0 and galactic latitude b=0.

A detector's key figure of merit for the identification of an astrophysical point source of γ-rays, is its *point source sensitivity*. It is defined as the minimum source flux required to achieve a specified level of detection significance. The significance S of a detection is given schematically by:

$$S(>E_t) \sim \frac{N(>E_t)}{\sqrt{B(>E_t)}}, \tag{9}$$

where $N(>E_t)$ and $B(>E_t)$ are respectively the total number of detected photons from the source and the number of background photons falling within the source area above an energy E_t. E_t is usually the instrument's threshold energy. N and B are a function of the effective detection area $A(E)$ of the instrument, its angular resolution expressed as a solid angle $\Omega(E)$, the viewing time t, and the differential source and background spectra dN/dE and dB/dE:

$$N(>E_t) = \int_{E_t}^{\infty} \frac{dN}{dE} A(E) t dE, \tag{10}$$

and

$$B(>E_t) = \int_{E_t}^{\infty} \frac{dB}{dE} A(E)\Omega(E) t dE. \tag{11}$$

Here, the source spectrum dN/dE corresponds to the photons differential spectrum obtained by the mSUGRA as a function of the halo profile model and the choice of the SUSY parameters, m_χ included. The background flux dB/dE contains components from the isotropic extragalactic γ-ray background radiation and from the galactic diffuse radiation (the latter due mainly to the decay of π^0s produced in collision of cosmic rays with the interstellar medium). The former has been determined by EGRET to be [24]:

$$\frac{dB_{extragal.}}{dE} = \Phi_0 \times \left(\frac{E}{k_0}\right)^{\epsilon} (cm^2 s sr GeV)^{-1}, \tag{12}$$

where Φ_0=(7.32 $\pm$ 0.34) $\times$ 10^{-6} (cm^2 s sr GeV)$^{-1}$, k_0=0.451 GeV and ϵ=2.10 $\pm$ 0.03.

The $\frac{dB_{extragal.}}{dE}$ is the dominant background at the GC for energies > 40 GeV, while, at lower energy, for the diffuse Galactic background, the same average model [25] [26] used for the production of the third EGRET Catalog has been considered (Fig. 1). We have parametrized it as:

$$\frac{dB_{Gal.}}{dE} = \Phi_{0G} \times \left(\frac{E}{q_{0G}}\right)^{\epsilon_G} (cm^2 s sr GeV)^{-1}, \tag{13}$$

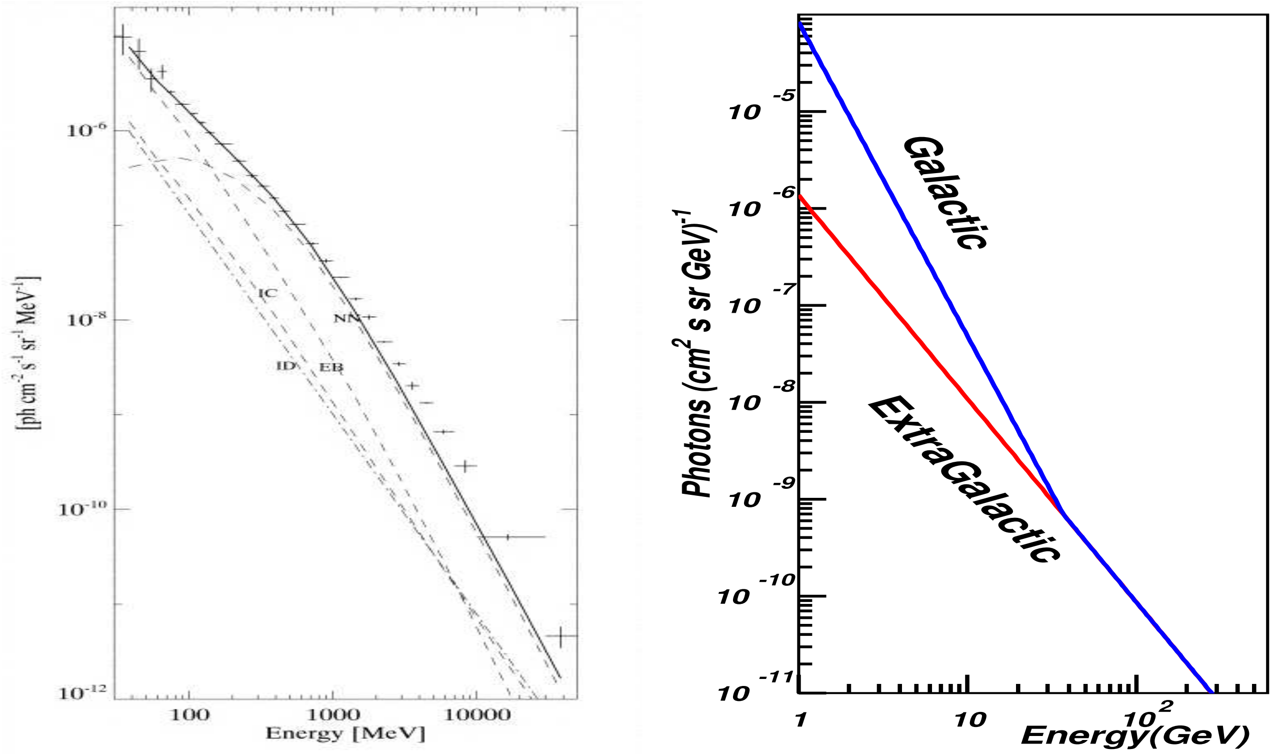

Figure 1: Left) Average diffuse gamma-ray spectrum of the inner Galaxy region. The contributions from point sources detected with more than 5 σ significance have been removed. Right) Average diffuse gamma-ray spectrum of the inner Galaxy region together with ID extragalctic spectrum to which the galactic one reduces itself for energy $>$ 40 GeV.

where Φ_{0G}= 5.747 $\times$ 10^{-6} (cm^2 s sr GeV)$^{-1}$, q_{0G}=2.292 GeV and ϵ_G=3.24.

The solid angle $\Omega(E)$ over which the background must be integrated when viewing a source is given by $\Omega(E)$=$\pi\sigma^2_{68}(E)$, where σ_{68} is the detector angular resolution and, following the EGRET's usage, it is defined as the angular radius within which 68% of the source photons fall.

Finally, for the calculation of the GC time viewing t, the time evolution of the 3 year AMS mission on board the ISS has been also simulated[23]. AMS will be rigidly attached to the Space Station which itself will be in 51.6^o inclination orbit, AMS will not spend equal amounts of time viewing all directions in the celestial sphere. Full sky coverage is obtained about 5.3 times per year due to the precession of the orbital plane of the ISS about Earth's pole. Because of this precession, the viewing area $\times$ time product (the *exposure*) over the sky is only a function of E (since the effective area will depend on it) and celestial coordinates. By following the orbit of AMS over three years, the effective

Table 4: Numbers of photons detected by AMS02 in 1 year from the Galactic Centre. Two profiles of halo are considered: Navarro-Frenk-White and Moore.

model	N_γ(NFWstd)	N_γ(NFWmax)	N_γ (Moore)
B	1.5	83	156
C	0.1	6	18
G	0.6	45	111
I	3.6	258	525
L	15.0	597	1416

area $A(E,\theta) \times t$, the time spent by the detector viewing the Galactic Center within a specific viewing inclination $d\theta$, has been calculated and then integrated over the full viewing θ range (up to 42^o with tracker and 22^o with ECAL). The time intervals when ISS orbits over the South Atlantic Anomaly region have been subtracted.

We define preliminarly the GC point sensitivity in an approximative way by neglecting the form of the energy spectrum of the photons produced in the neutralino annihilations, independently on m_χ, but considering only the galactic average background flux. Thus the sensitivity is the flux $F(E)$ which gives a total number of photons $\geq S$ times the standard deviation σ of the background B, integrated over the period of 3 years of operation of AMS and for E_t threshold:

$$\int_{E_t}^{\infty} F(E)A(E)tdE = S \times \sqrt{B(>E_t)}, \tag{14}$$

e.g. the 95% CL is obtained by assuming S=3 and requiring a minimum 3 detectable photons.

In Table 4 the total number of photons with energies above 3 GeV detected during 3 year by AMS experiments are presented. The obtained numbers show that only in case of a favourable dark matter halo parametrization, AMS will be able to study the dark matter in the Galactic Centre. In these calculations no factor from SBH or clumpiness enhancement has been applied yet. We should also remind here, that the conidered mSUGRA models with large m_0 values are those which predict high γ fluxes.

3.2.3 Predictions from "wild scan" simulations

We have also performed a "wild scan" in the mSUGRA parameter space. To achieve this, three thousand models have been simulated in the $0.025 \lesssim \Omega_\chi h^2 \lesssim 0.3$ region. The value of the lower limit on $\Omega_\chi h^2$ equal to 0.025 has been used with a renormalization procedure for flux estimation described in [8] (for $\Omega_\chi h^2 \lesssim 0.1$). The low values of $\Omega_\chi h^2$ may indicate that the main component of the dark matter is not the SUSY LSP and other contributions should be considered.

The conditions of the performed simulations were for mSUGRA 5 parameters:

$$\begin{gathered}
\mathrm{sign}(\mu) \text{ not constraint} \\
50. < m_0 < 3000. \\
50. < m_{1/2} < 1600. \\
0.1 < |A_0| < 2000. \\
3. < tan(\beta) < 60.
\end{gathered}$$

All results for the integrated gamma fluxes from GC as a function of the χ_1^0 mass were obtained for a NFW(std) profile described in section 2, and for γ-ray energy threshold of 3 GeV. The decay channels with π^0 in the final state subsequently decaying into γs, such as b$\bar{\text{b}}$, W^+W^-, Z^0Z^0, HH, ..., were provided by the PYTHIA 6.1 program which is included in data format of the DarkSUSY package.

Figure 2 presents mSUGRA results in case of the so-called "Focus Point" inspired scenario where m_0 values may vary up to 3 TeV. In this case there are more viable models with a neutralino of comparatively large Higgsino content than in generic mSUGRA models or MSSM. Each point on the plot corresponds to a mSUGRA model and the computed fluxes are those obtained with NFW (std) and NFW (max) parametrizations.

The 95% CL was obtained by fluctuating the diffuse γ background spectrum as measured by EGRET experiment [26] in the GC area, as described in previous section. Asking for a minimum of 3 photons over 3σ of the diffuse gamma background, with 3 GeV threshold in energy and exposure time of 3 years one gets the sensitivity to GC measurement of $(2.0 \pm 0.4)10^{-9} cm^{-2} s^{-1}$. In future work, the exclusion limit depending on $m_{\chi_1^0}$ will be provided.

Figure 3 presents mSUGRA results as in figure 2 with AMS detector acceptance corrections have been applied in a preliminary way. One may observe, that even with pessimistic astrophysical conditions, the typical observation time of 100 hours would yield few γ for large $tan\beta$ models and $m_\chi > 100 GeV$.

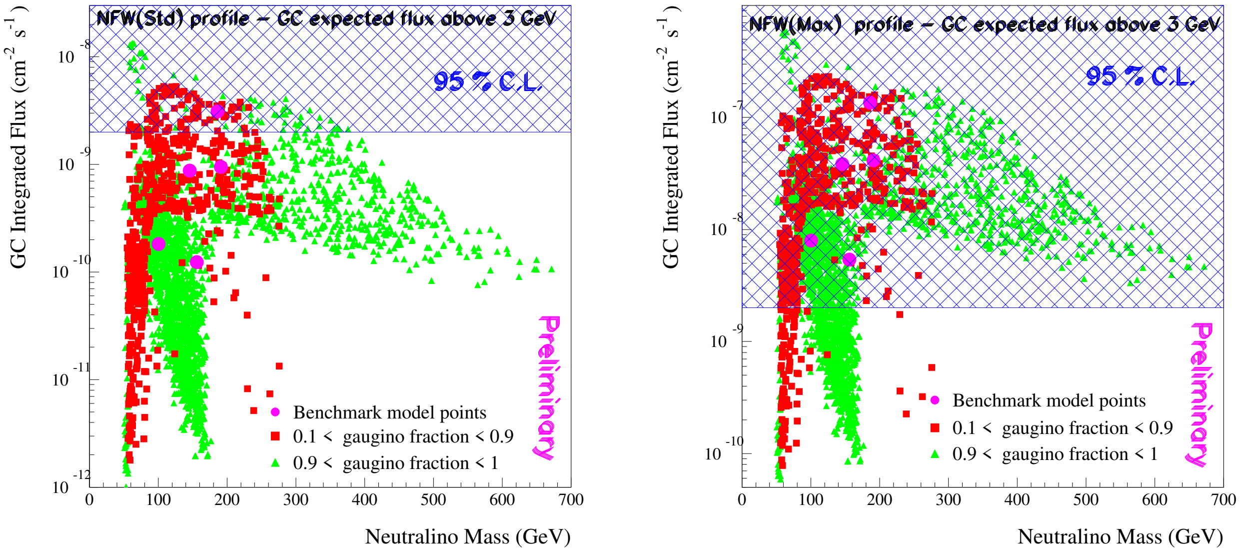

Figure 2: the integrated γ flux from GC as a function of m_χ in the so-called Focus Point scenario (large m_0 values), for NFW (std) and NFW (max) halo profile parametrizations.

Conclusions

The DarkSUSY and SUSPECT MC programs were used to produce the gamma flux predictions for the benchmark models in AMS experiment. Only models I and L (large $tan\beta$) could be considered as favourable for the detection. This conclusion is confirmed by a further study of the so-called "wild scan" simulation in mSUGRA scheme. Various aspects such as dependence of the results on heavy quark masses or CP-odd higgs pole contribution may change the predictions [8]. The strongest signal corresponds to supersymmetric configurations where the neutralino mass m_χ exceeds $\sim$ 100 GeV. The one year data in AMS detector would allow to make 95% CL exclusions of the several mSUGRA models in case of an optimistic dark matter galactic halo parametrization such as a very cuspy NFW or Moore profiles. On the other hand, if the halo is made of clumps with inner profiles like Moore type or if there is a strong accretion going on around the central black hole, the expected signal may be enhanced up to two orders of magnitude. Taking into account the excellent energy resolution in AMS detector, the observed signal may even lead to a discovery. We therefore conclude that a survey of GC with AMS experiment opens new prospects for direct dark matter searches.

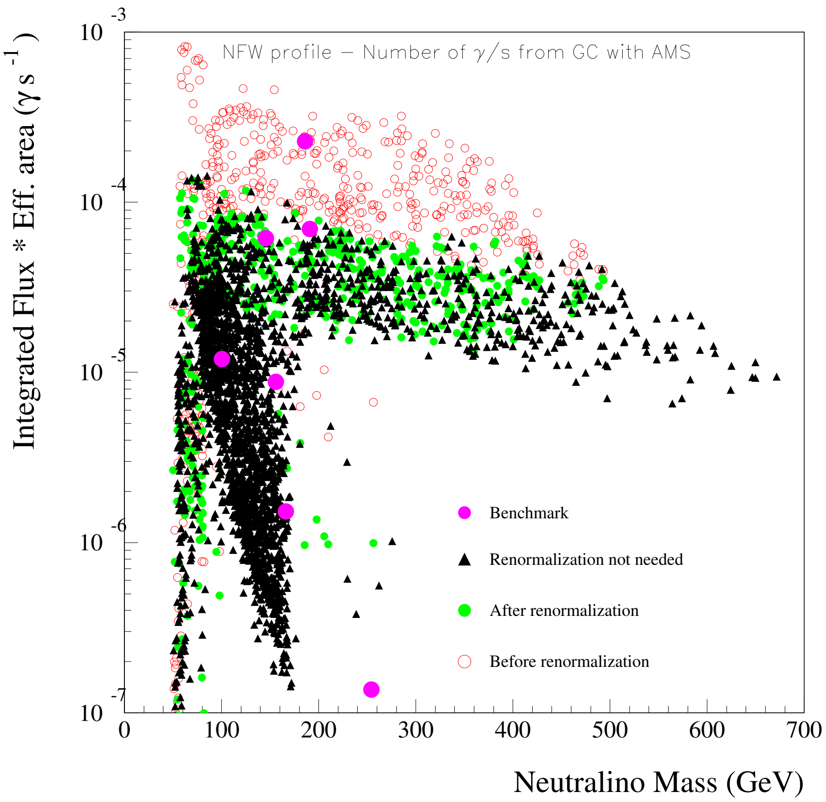

Figure 3: the integrated N_γ from GC as a function of m_χ as in figure 1, convoluted with the AMS acceptance - Tracker and Ecal.

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