

Notes on IceCube SUSY scans
(C. de los Heros. Uppsala)
Marseille workshop Dec 13-14, 2011

IceCube has used DarkSUSY so far to perform scans on the MSSM and cMSSM.

We keep a list of saved variables for each model that passes the scan constraints (is compatible with current direct searches and with cosmological inputs, except the local dark matter density, which we keep quite generous).

Variables 2 to 8 below are the ones that define a given model, and are those that are randomly chosen in the scans. All the rest are derived variables. The scan was made by choosing a random number between the following limits for each of the mentioned variables:

$$10 < \mu < 30000, \quad 10 < M_2 < 30000, \quad 10 < M_A < 30000, \quad 1 < \tan\beta < 60,$$
$$10 < m_0 < 30000, \quad -3m_0 < A_t < 3m_0, \quad 3m_0 < A_b < 3m_0$$

We have not put any limit on the relic density, but just saved the value of Ωh^2 predicted by each model. It is up to the user when using the files to make plots to select models which comply with current Ωh^2 limits

The **variables saved** are the following (in the same order that appear in the output files):

- 1.ID tag: a sequential number tagging the model
2. μ : mass scale of the neutralinos, higgsinos and winos. μ also sets the strength at which SUSY comes in. It would be the only free parameter in unbroken SUSY (GeV)
3. M_2 : Gaugino mass parameter (GeV)
4. m_A : mass of the third neutral (and CP-odd) higgs boson, A (GeV)
5. $\tan\beta=v_1/v_2$: ratio of the vacuum expectation values of two of the three neutral higgs bosons in the MSSM, H_1 and H_2
6. m_0 : mass scale of the sfermion sector. In MSSM set to the electroweak scale. In MSUGRA, set to the GUT scale (GeV)
7. A_t : sets the degree of mixing between the left and right components of the stop

8. A_b : sets the degree of mixing between the left and right components of the sbottom
9. m_χ : neutralino mass (GeV)
10. m_{ch1} : first chargino mass (GeV)
11. m_{ch2} : second chargino mass (GeV)
12. Ωh^2 : the neutralino relic density predicted by the current model
13. σ_v : velocity averaged neutralino-neutralino annihilation cross section (cm^3s^{-1})
14. Φ_μ^S : Muon flux from the Sun ($\text{km}^{-2}\text{yr}^{-1}$)
15. Φ_ν^S : Neutrino flux from the Sun ($\text{km}^{-2}\text{yr}^{-1}$)
16. Φ_μ^E : Muon flux from the Earth ($\text{km}^{-2}\text{yr}^{-1}$)
17. Φ_ν^E : Neutrino flux from the Earth ($\text{km}^{-2}\text{yr}^{-1}$)
18. σ_{SI}^p : Neutralino-proton spin independent Xsection (cm^2)
19. σ_{SI}^n : Neutralino-neutron spin independent Xsection (cm^2)
20. σ_{SD}^p : Neutralino-proton spin dependent Xsection (cm^2)
21. σ_{SD}^n : Neutralino-neutron spin dependent Xsection (cm^2)
22. Γ^S : Annihilation rate in the Sun (s^{-1})
23. C^S : Annihilation rate in the Sun (s^{-1})
24. Γ^E : Annihilation rate in the Earth (s^{-1})
25. C^E : Annihilation rate in the Earth (s^{-1})
26. ϵ_G : Gaugino fraction of the neutralino
27. ϵ_H : Higgsino fraction of the neutralino

In the case of the cMSSM scans, the **variables saved** are the following (in the same order that appear in the output files):

1. ID tag: a sequential number tagging the model
2. m_0 : common scalar mass (GeV). The mass terms of the squarks, sleptons and Higgs bosons at the GUT scale
3. $m_{1/2}$: common gaugino mass (GeV). The MSSM $M_1(\text{GUT}) = M_2(\text{GUT}) = m_{1/2}$

4. A_0 : Unified value at the GUT scale of A_t and A_b of the MSSM
5. $\tan\beta=v_1/v_2$: ratio of the vacuum expectation values of two of the three neutral higgs bosons in the MSSM, H_1 and H_2
6. $\text{sign } \mu$: sign of the coupling term between the two Higgs doublets in the lagrangian
7. m_χ : neutralino mass (GeV)
8. m_{ch1} : first chargino mass (GeV)
9. m_{ch2} : second chargino mass (GeV)
10. Ωh^2 : the neutralino relic density predicted by the current model
11. σ_v : velocity averaged neutralino-neutralino annihilation cross section (cm^3s^{-1})
12. Φ_μ^S : Muon flux from the Sun ($\text{km}^{-2}\text{yr}^{-1}$)
13. Φ_ν^S : Neutrino flux from the Sun ($\text{km}^{-2}\text{yr}^{-1}$)
14. Φ_μ^E : Muon flux from the Earth ($\text{km}^{-2}\text{yr}^{-1}$)
15. Φ_ν^E : Neutrino flux from the Earth ($\text{km}^{-2}\text{yr}^{-1}$)
16. σ_{SI}^p : Neutralino-proton spin independent Xsection (cm^2)
17. σ_{SI}^n : Neutralino-neutron spin independent Xsection (cm^2)
18. σ_{SD}^p : Neutralino-proton spin dependent Xsection (cm^2)
19. σ_{SD}^n : Neutralino-neutron spin dependent Xsection (cm^2)
20. Γ^S : Annihilation rate in the Sun (s^{-1})
21. C^S : Annihilation rate in the Sun (s^{-1})
22. Γ^E : Annihilation rate in the Earth (s^{-1})
23. C^E : Annihilation rate in the Earth (s^{-1})
24. ε_G : Gaugino fraction of the neutralino
25. ε_H : Higgsino fraction of the neutralino