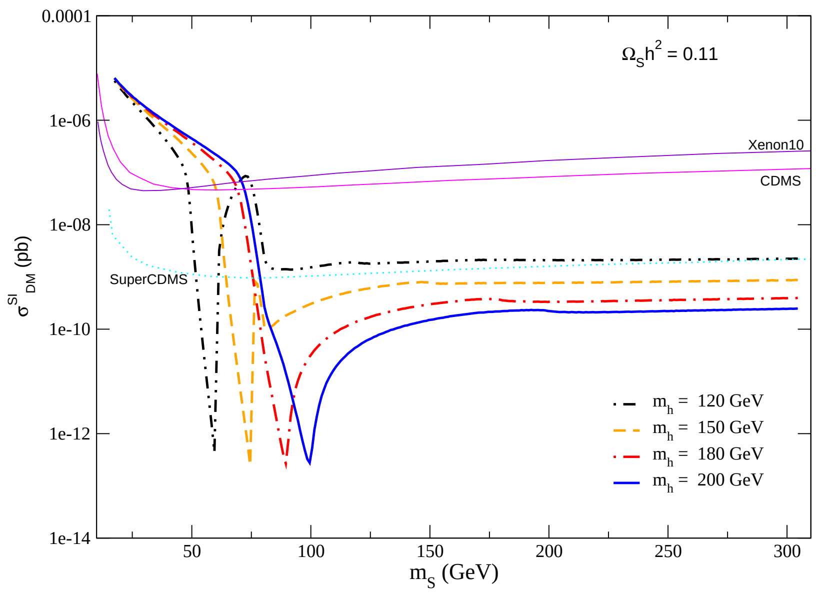
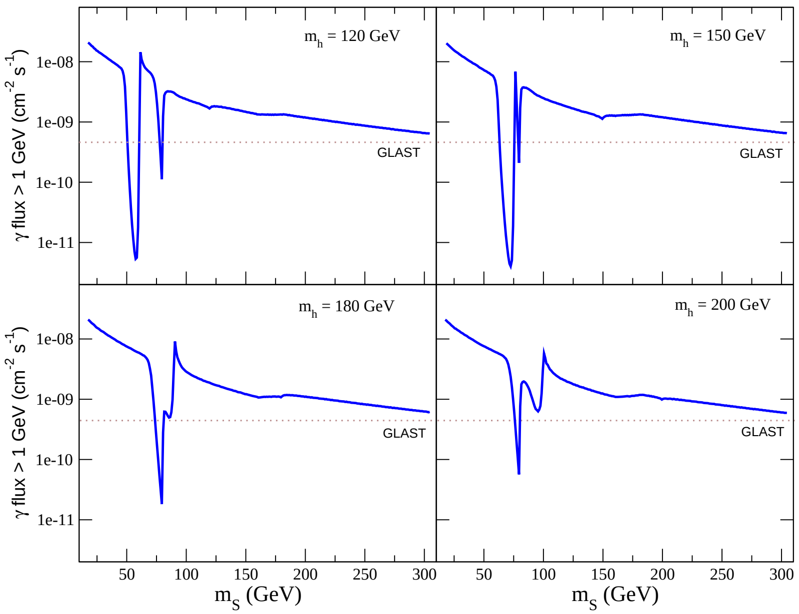
Gamma rays from singlet scalar dark matter

arXiv:0810.4267





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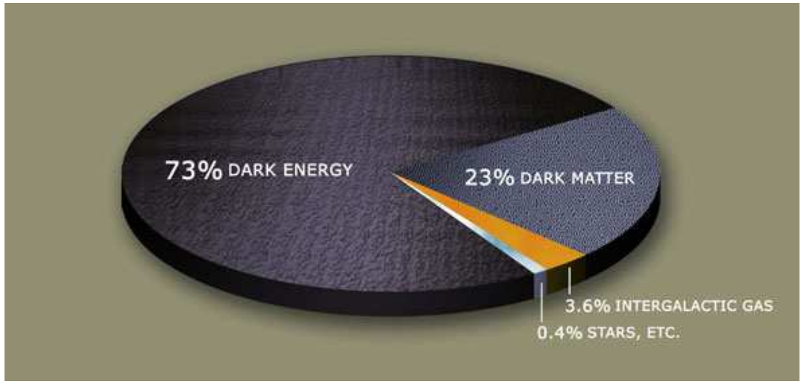
The singlet scalar model is a simple extension of the SM that can explain the dark matter

The SM is successful but it cannot account for the DM



Let us extend the SM with one additional field: S

S is a singlet scalar

And a discrete symmetry Z_2 to render it stable

$$\mathscr{L} = \mathscr{L}_{SM} - \frac{1}{2}m_0^2 S^2 - \lambda S^2 H^\dagger H - \frac{1}{4}\lambda_S S^4$$

We present a new analysis of the parameter space and compute the expected γ ray flux

The parameter space was last studied in 2000

McDonald, 1994
Burgess et. al, 2000

Since then there's been plenty of new data

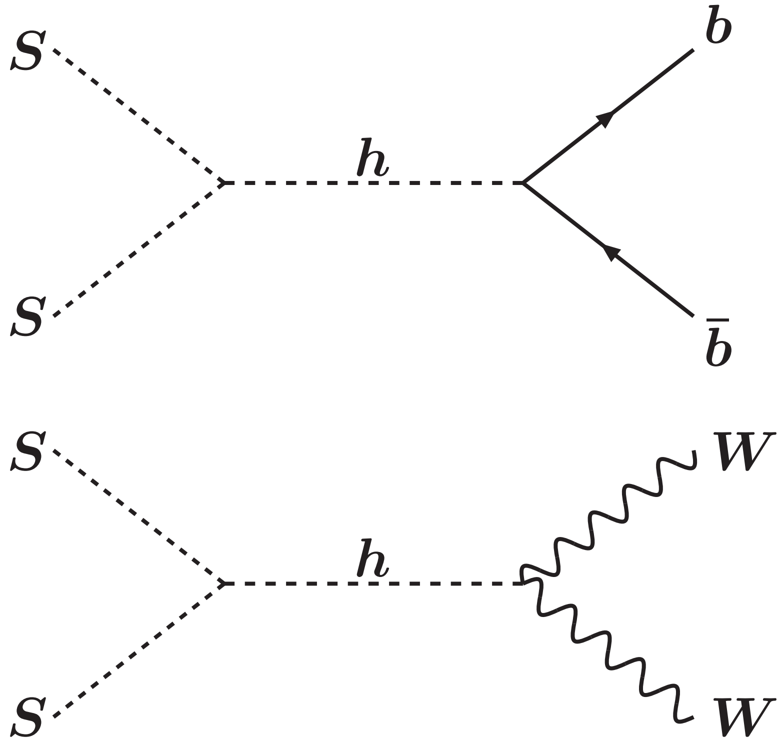
Wmap, higgs mass, direct detection experiments

The γ ray flux had not been computed before

Singlets annihilate mainly through s-channel higgs boson exchange

For light singlets $b\bar{b}$ is the dominant final state

For heavier singlets W^+W^- becomes dominant



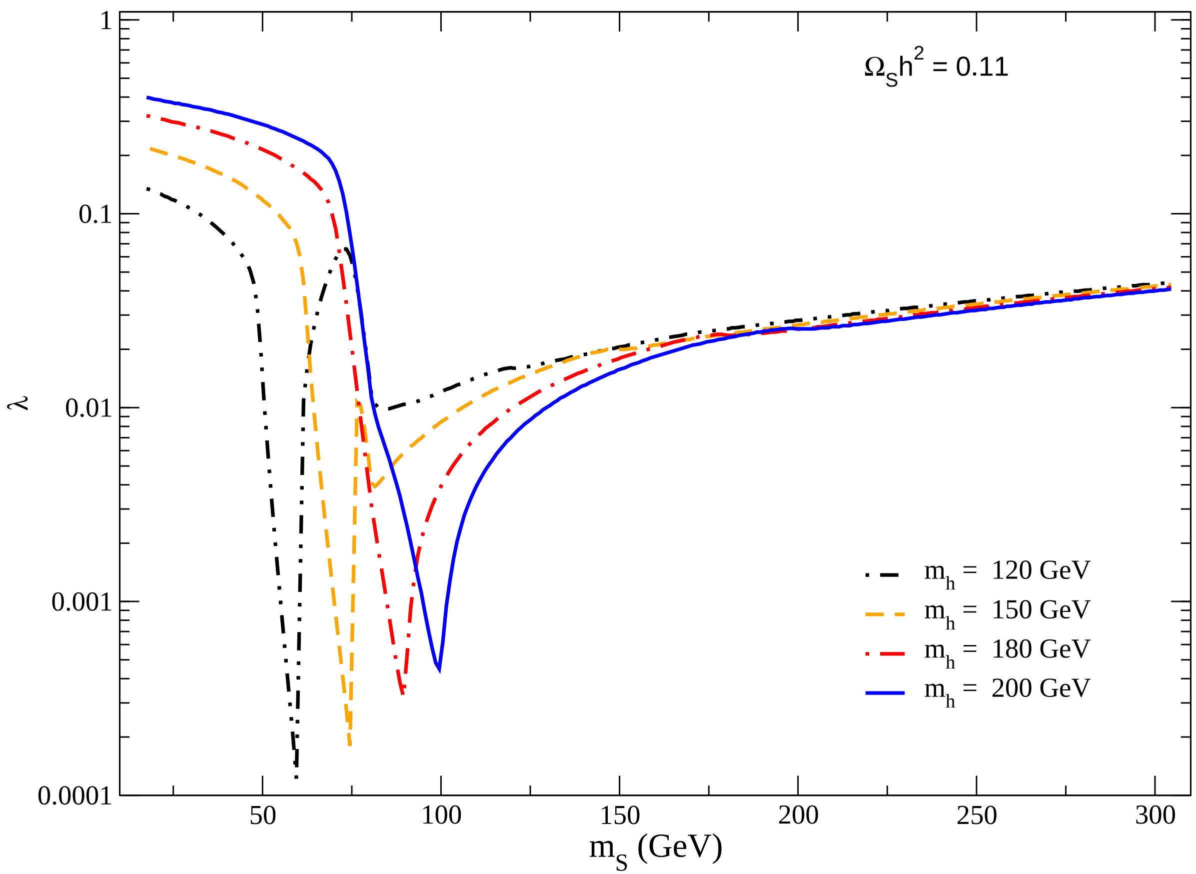
We use `micrOMEGAs` to compute the relic density

The relic density constraint leaves m_S as the only new parameter of the model

At the higgs resonance λ is small

If $m_S < m_W$ λ must be larger than about 0.1

If $m_S > m_W$ λ has to be of order 0.01

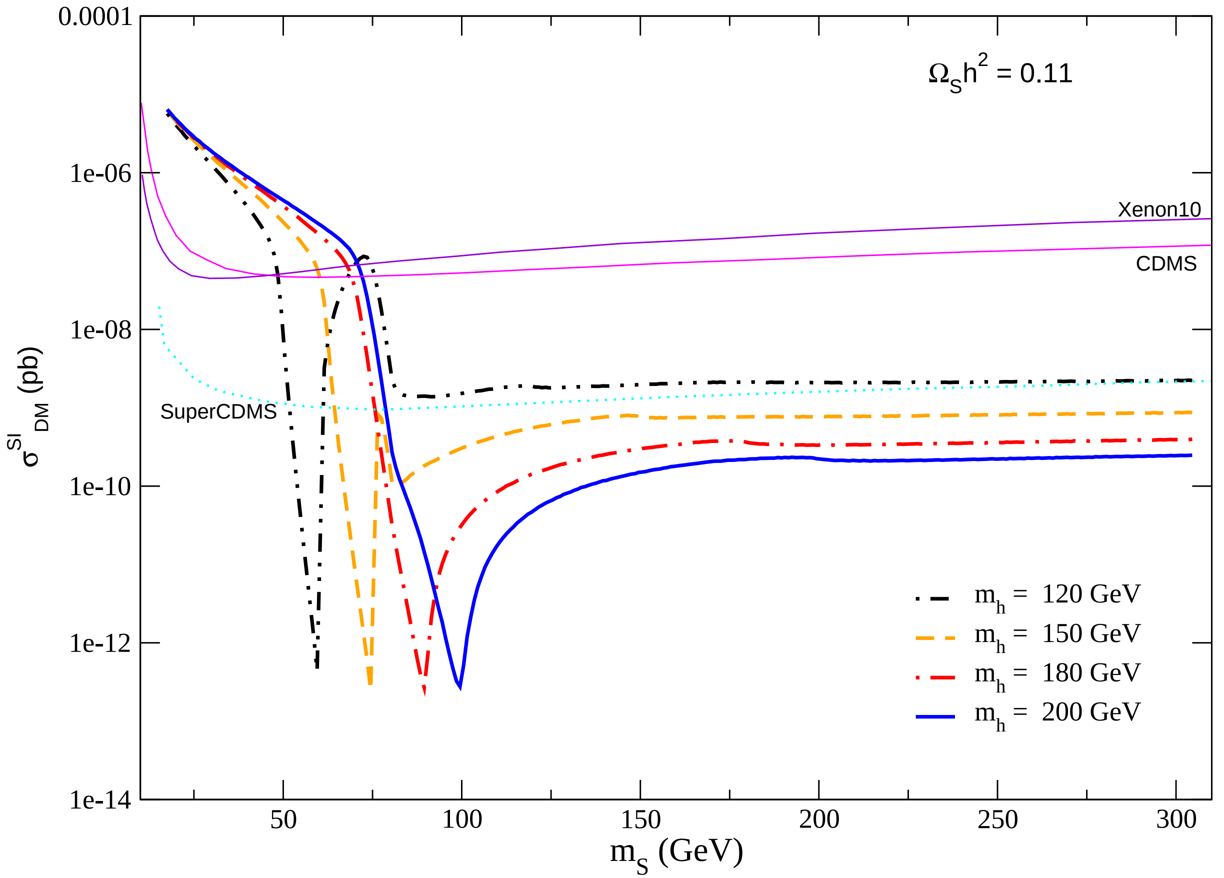


Direct detection constraints already require $m_S > 50$ GeV

Around the resonance σ_{SI} is suppressed

σ_{SI} decreases with the higgs mass

Current bounds rule out light singlets

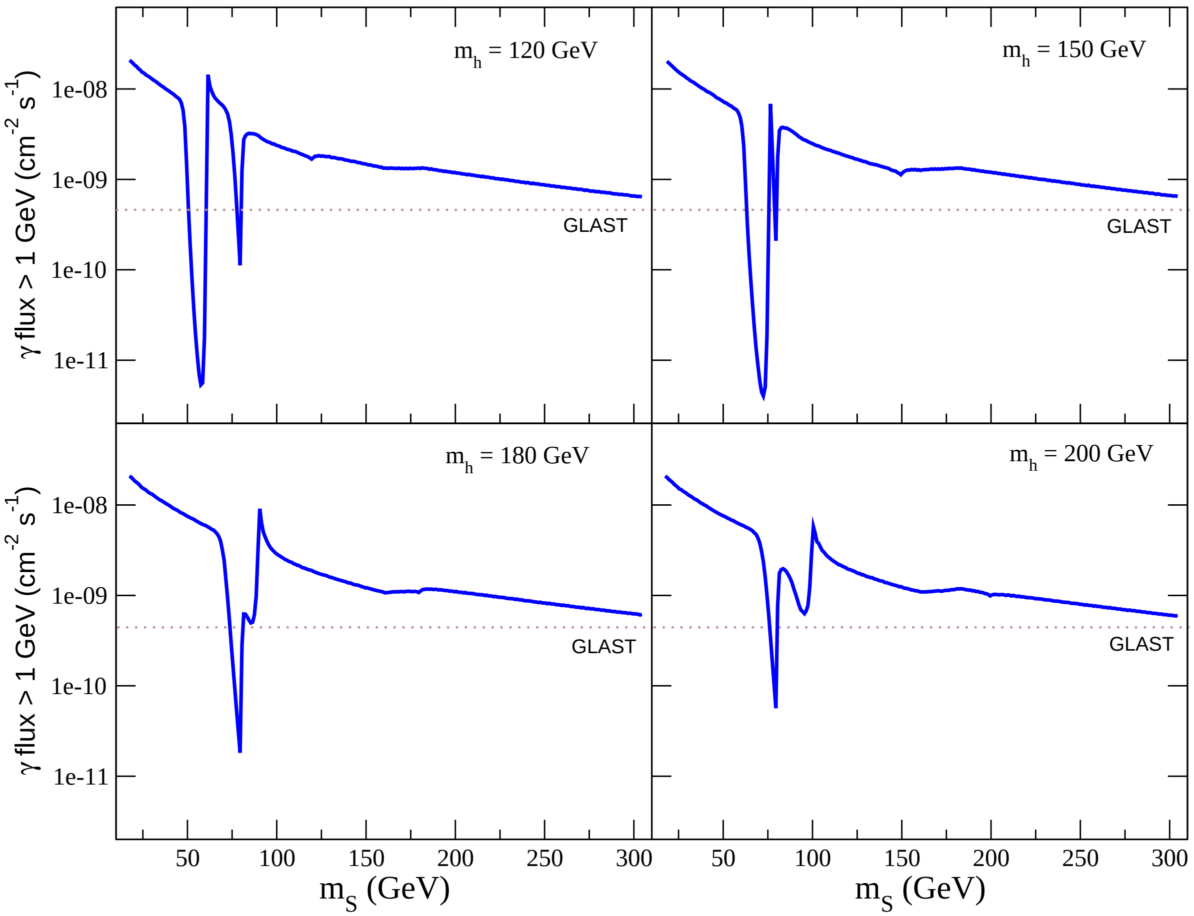


The expected gamma ray flux is within the sensitivity of GLAST

The flux has a global $1/m_S^2$ dependence

It has a dip at $m_S \sim m_h/2$ and at $m_S \sim m_W$

If $m_S < 300$ GeV GLAST is likely to observe the γ's



A singlet scalar is an appealing dark matter candidate

It provides an alternative to SUSY DM

The model is simple and very predictive

Detection rates should be significant