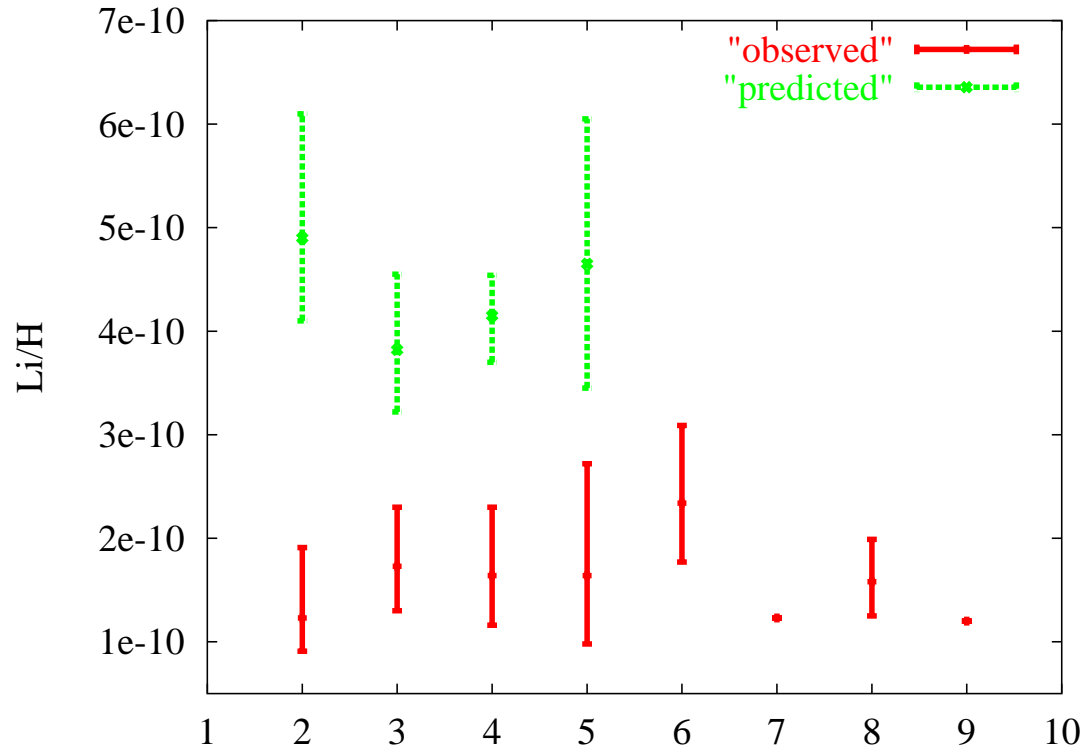


# The Cosmic Lithium Problems and Supersymmetric Dark Matter

Karsten JEDAMZIK<sup>†</sup>

<sup>†</sup> LPTA, Montpellier

# The ${}^7\text{Li}$ Problem

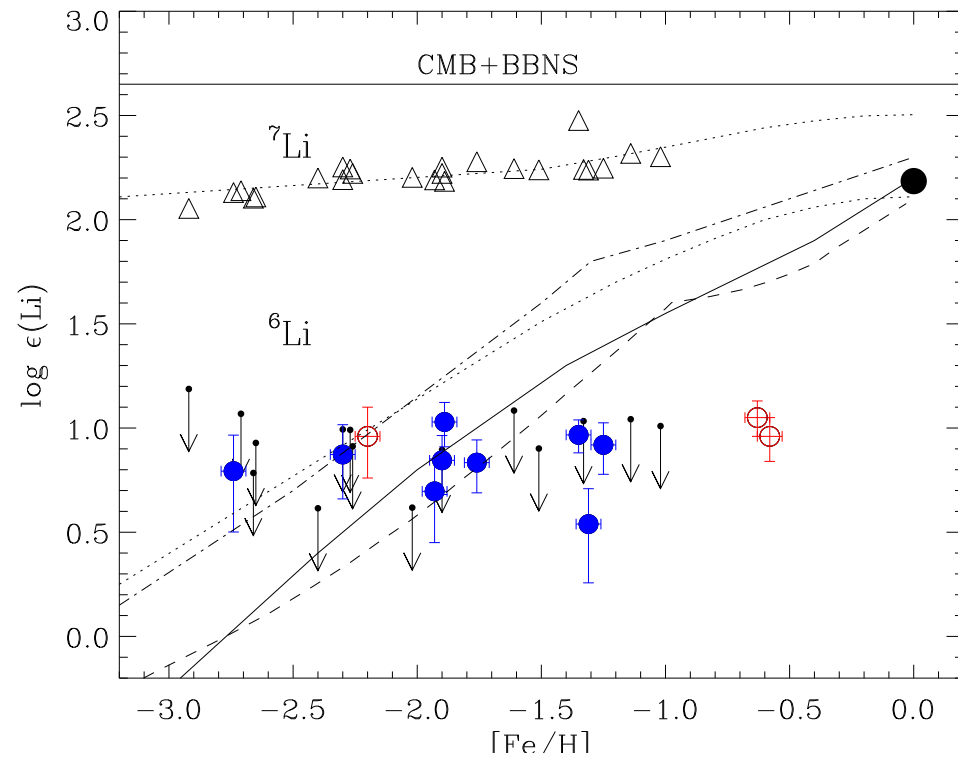


Ryan *et al* 00; Bonifacio & Molaro 97; Charbonnel & Primas 05; Boesgard *et al* 05, Melendez & Ramirez 04; Asplund *et al* 05; Bonifacio *et al* 03, Zhangf & Zhao 04  
Burles *et al* 01; Cyburt *et al* 04; Coc *et al* 04; Cuoco *et al* 04

Depletion of  ${}^7\text{Li}$  by factor 2 – 3 in halo stars is not understood and may currently only be explained with fine-tuned stellar conditions

# ${}^6\text{Li}$ at low metallicity: A surprise

Asplund, Lambert, Nissen, Primas, and Smith 05 (astro-ph/0510636)



## The ${}^6\text{Li}$ energetics problem:

- need *100 eV/nucleon* of cosmic ray energy to synthesize  ${}^6\text{Li}/\text{H}$  of  $10^{-11.3}$  at  $[\text{Z}] \approx -2.75$

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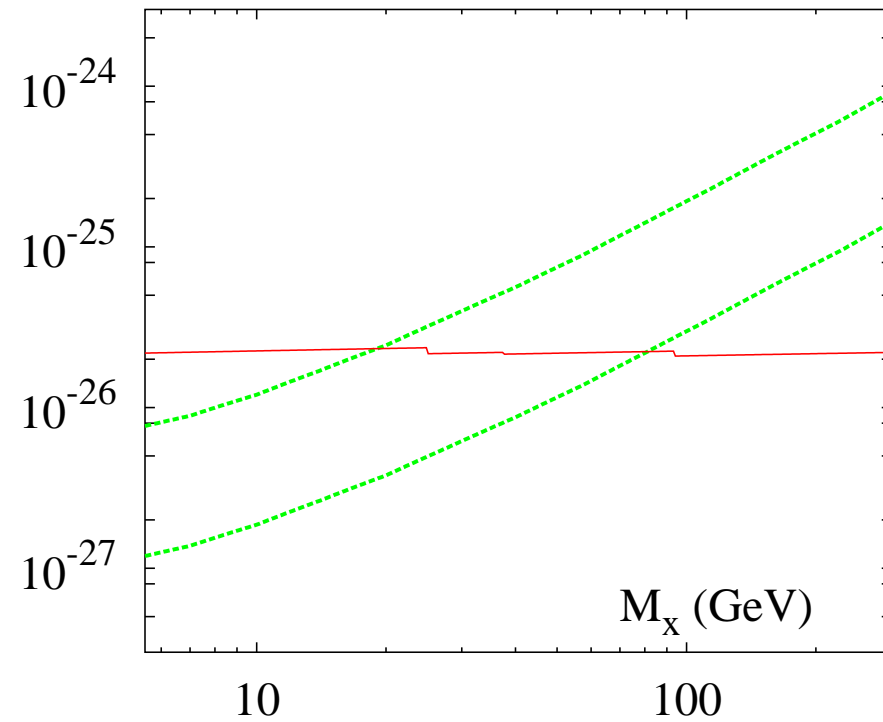
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*However, factor 2.5  ${}^7\text{Li}$  depletion  $\rightarrow$  factor 10 – 40  ${}^6\text{Li}$  depletion - even non-standard cosmic rays should have problems*



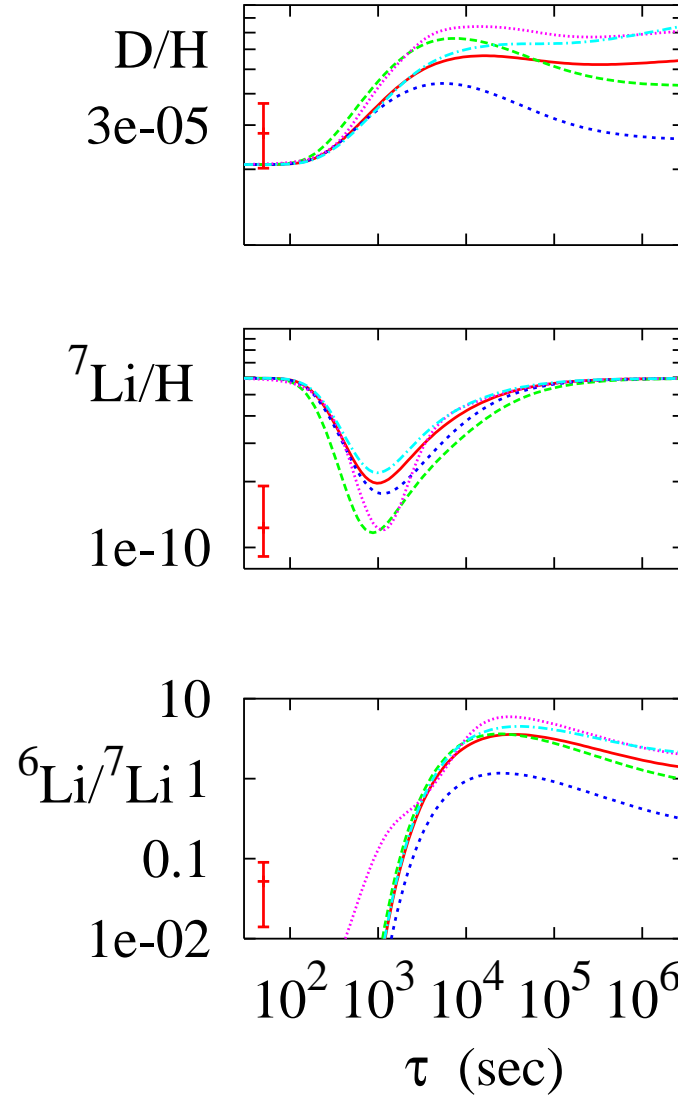
${}^6\text{Li}$  is easily produced during a slightly non-standard Big Bang nucleosynthesis Dimopoulos *et al* 88, K.J. 00,04ab, Kawaski *et al* 05

# ${}^6\text{Li}$ due to dark matter annihilation during BBN



K.J. Phys. Rev. D 70 083510 (2004) (astro-ph/0405583)

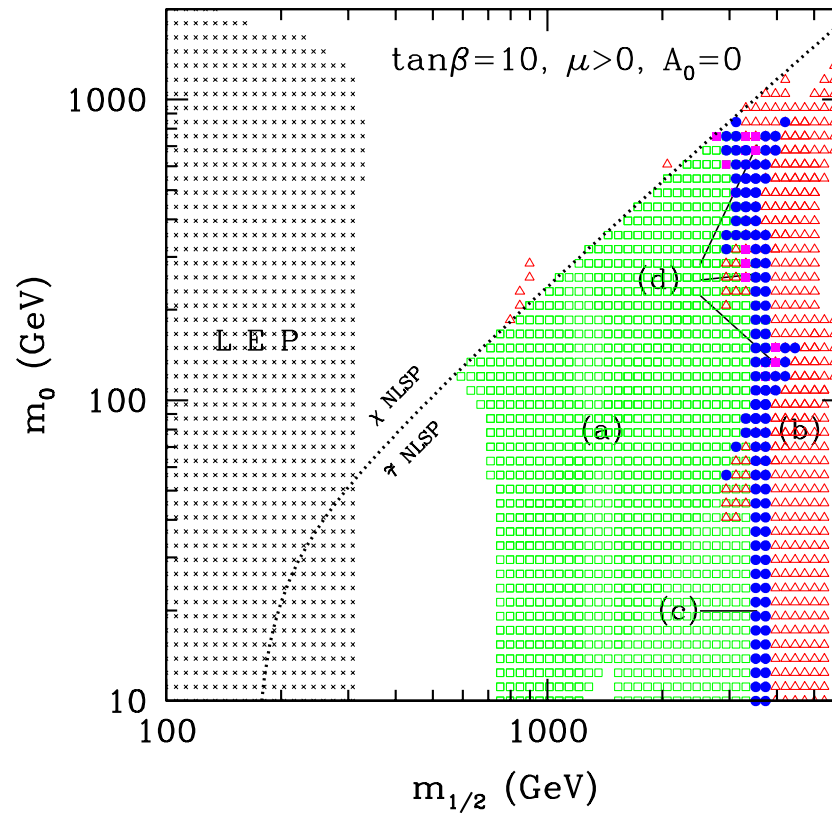
# Decaying particles/defects *during* BBN



K.J. Phys. Rev. D 70 063524 (2004); (astro-ph/0402344)

# The Cosmic Lithium Problems solved by Gravitino Warm DM

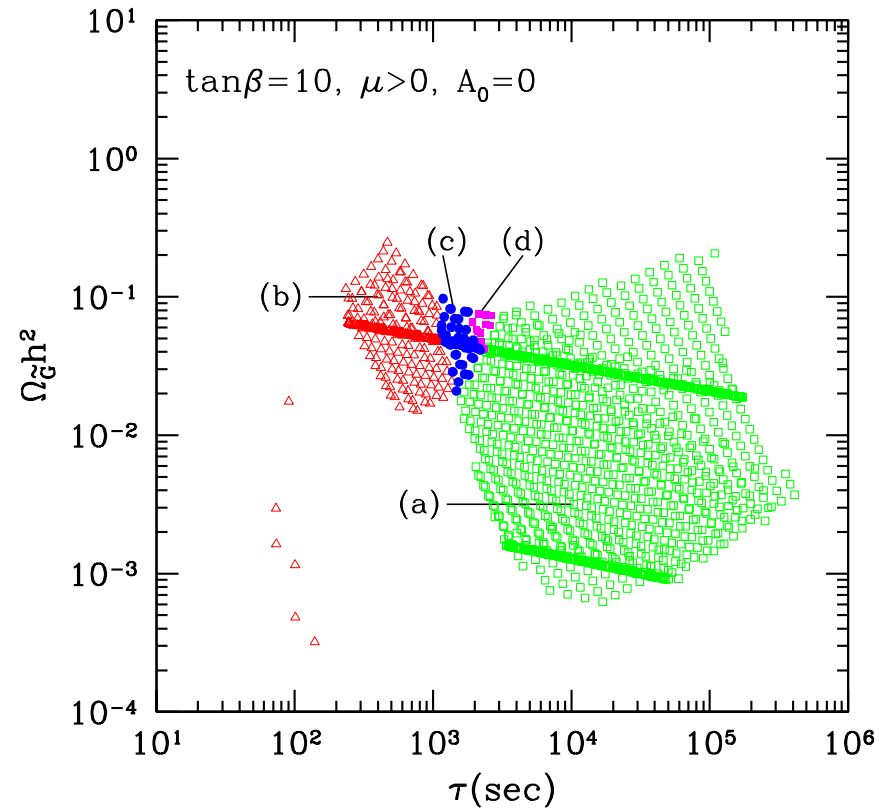
mSUGRA with gravitino LSP:



K.J., Ki-Young Choi, L. Roszkowski, R. Ruiz de Austri 05

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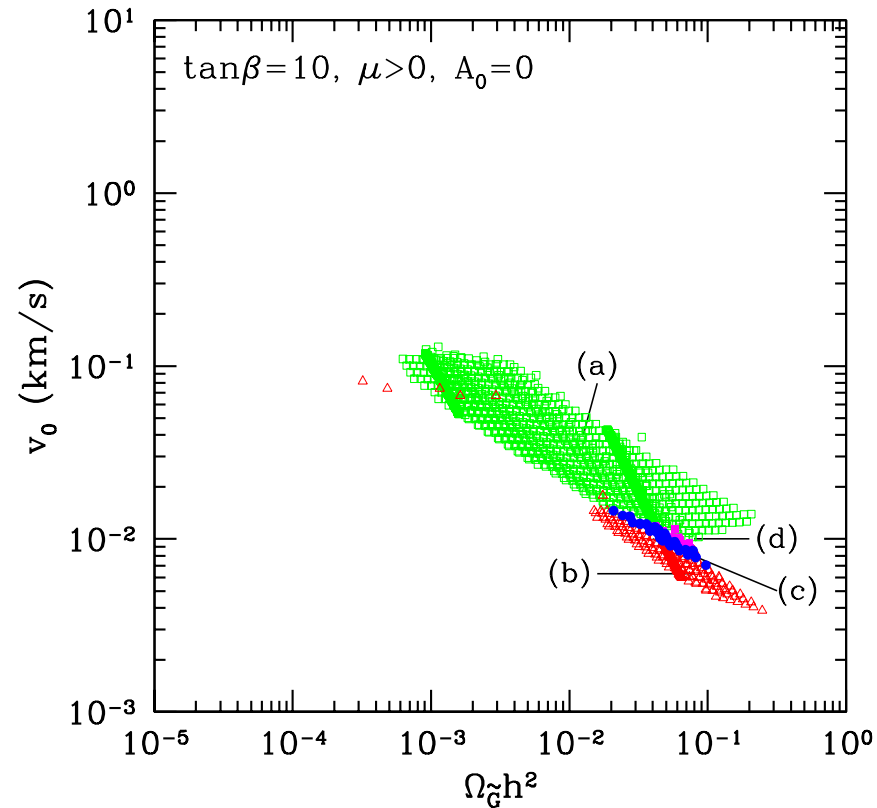
# The Cosmic Lithium Problems solved by Gravitino Warm DM

*Coincidentally right DM density !*

*independent of reheat temperature*

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mSUGRA with gravitino LSP:



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*Prediction: Dark Matter is Warm*



# Conclusions

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- stellar depletion of  ${}^7\text{Li}$  is possible, but factor 2 – 3 is hard to achieve
- It is difficult to explain the large  ${}^6\text{Li}$  abundance at low  $[Z]$ , particularly if  ${}^7\text{Li}$  depletion has to be invoked to solve the  ${}^7\text{Li}$  problem

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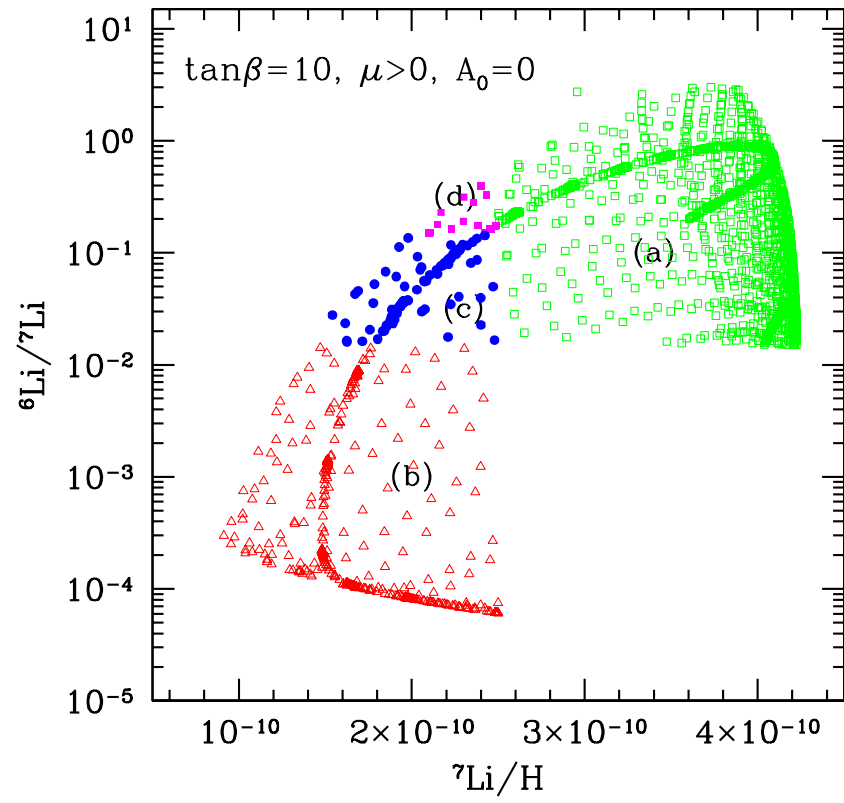
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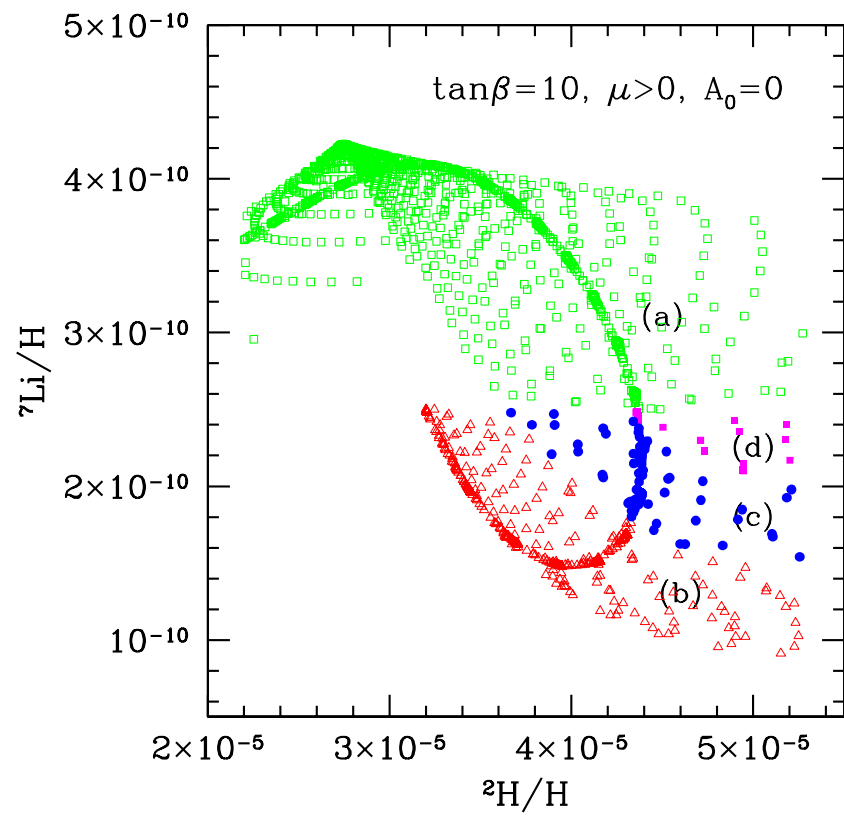
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- Do the anomalies in the lithium isotopes tell us about the nature of (some) the cosmic dark matter ???

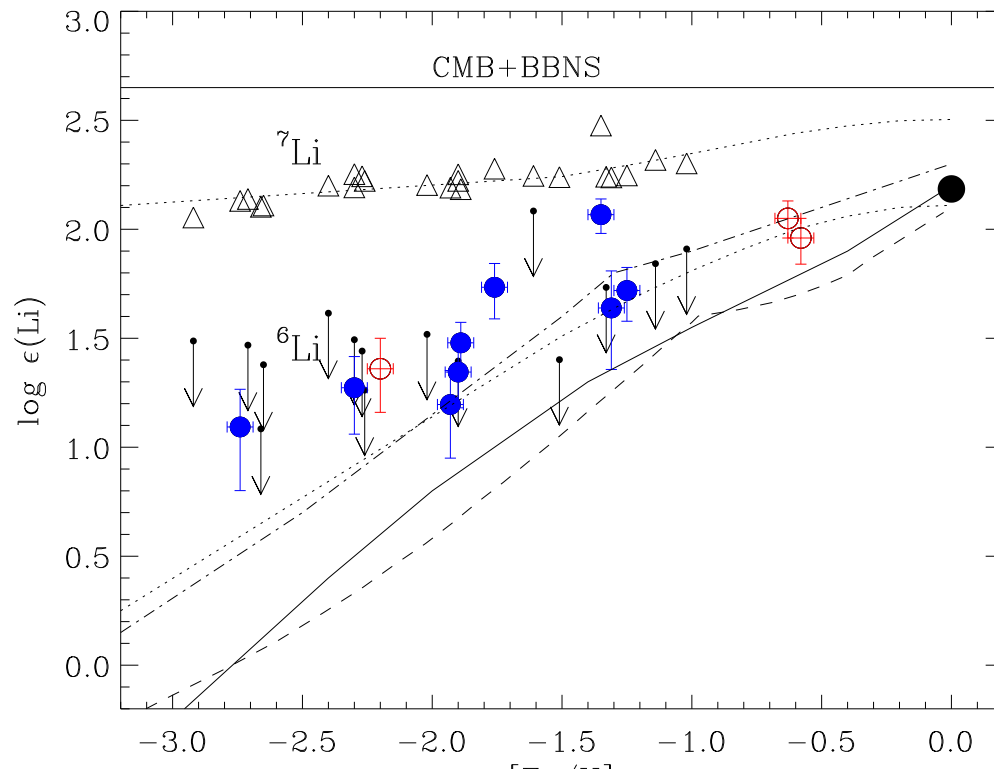






# ${}^6\text{Li}$ at low metallicity with PMS stellar destruction

Asplund, Lambert, Nissen, Primas, and Smith 05 (astro-ph/0510636), Richard, Michaud, Richer 05



# Production of ${}^6\text{Li}$ in cascade nucleosynthesis

production of energetic 3-nuclei by  ${}^4\text{He}$  spallation

${}^4\text{He}(n, np){}^3\text{H}$  ,  ${}^4\text{He}(p, pn){}^3\text{He}$  , ...

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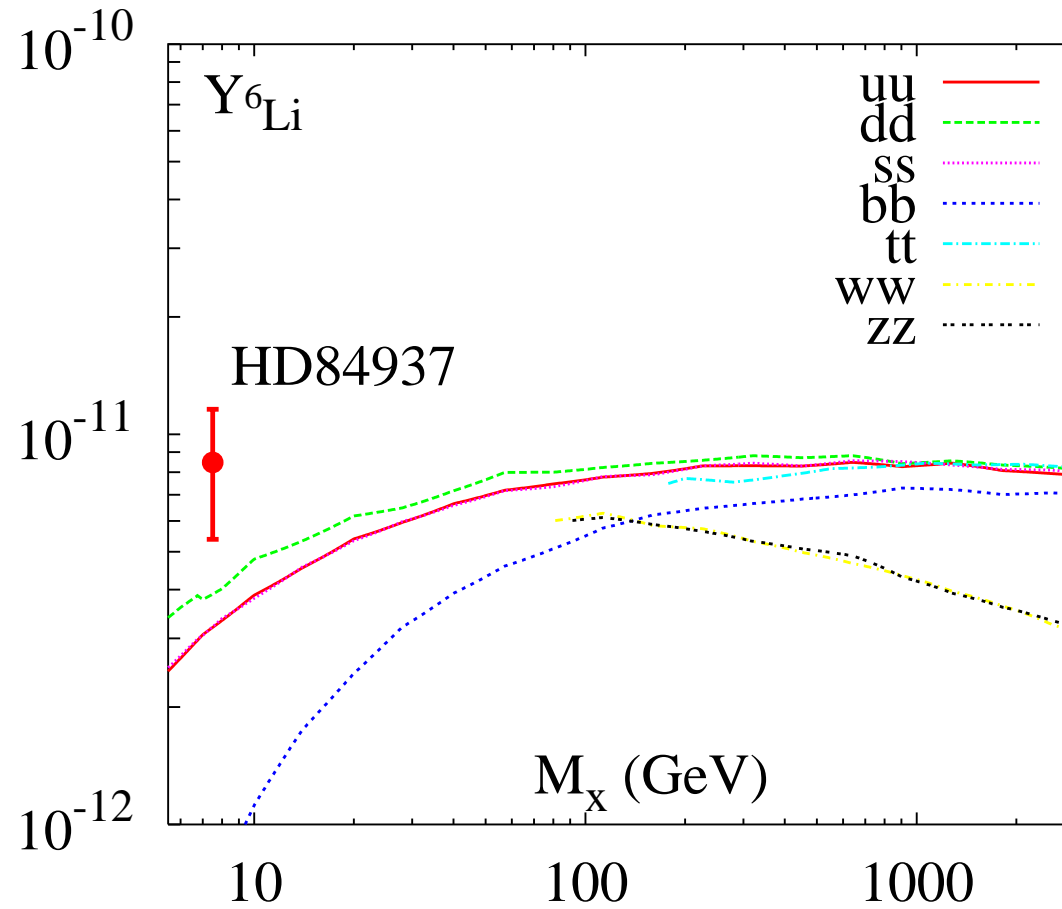
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thermalization of hadrons in plasma



# Yield functions



K.J. Phys.Rev. D 70 083510 (2004); (astro-ph/0405583)

# Decaying particles/defects *during* **BBN**

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