WMAP

<u>Stellar evolution</u>

Obs. ⟷ Theory

→ ←

<u>Chemical evolution of galaxies</u>

- time evolution
- galactic gradient
- X_i vs. [Fe/H]

YIELDS

<u>Definition:</u> stellar yields (Tinsley 1980)

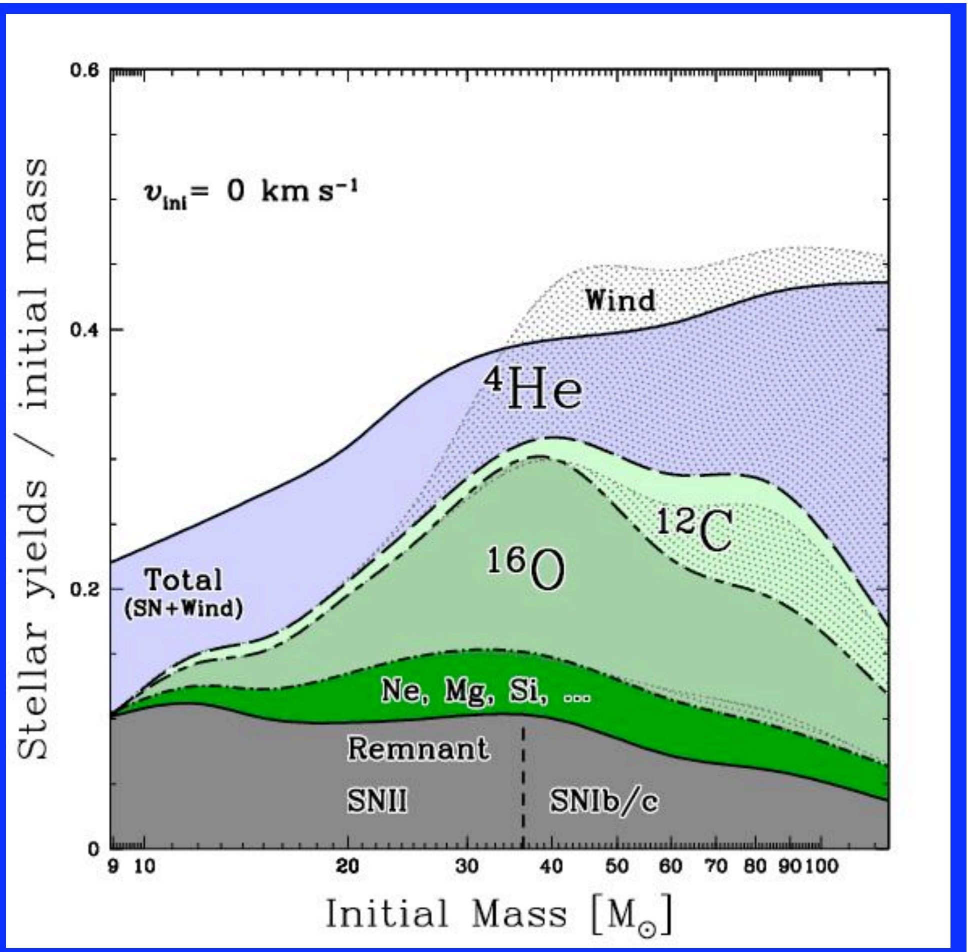
$m\ p_{im}$	mass of new elements ejected
m	initial mass
p_{im}	mass fraction of new elements ejected

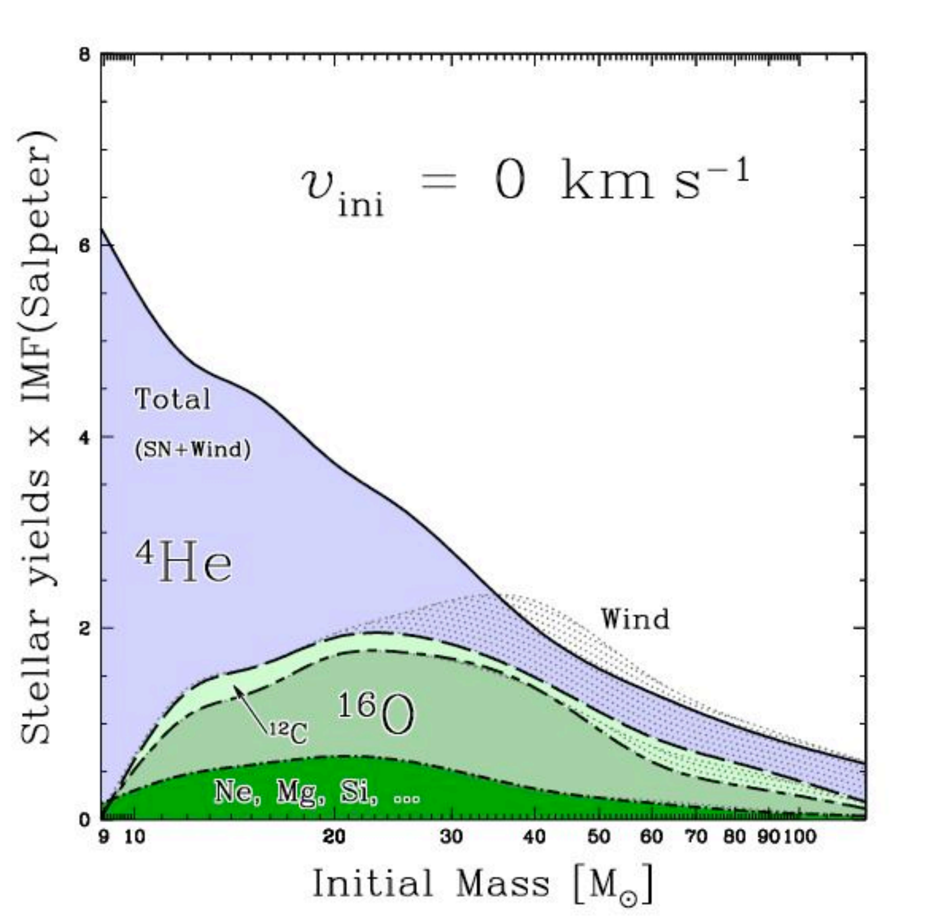
<u>The yields depends on all physical assumptions in models</u>

<u>One should not start by changing the IMF !</u>

^{4}He:

Depend on mass loss (WR)
mixing
M_{BH}
cutoff mass, etc…





ΔY/ΔO:

Y and O do not depend on the same mass range

Hirschi et al. 2004

Y_P = 0.2477 (M. Peimbert) t^2 effect
= 0.2512 (Y. Izotov)

$\Delta Y/\Delta Z = 3.3 \pm 0.7$ Recall $\Delta Y/\Delta Z \sim 1$ without mass loss

Questions:

- Does this slope vary with Z?

- Case of globular clusters (several bursts, with diff. compositions seen on the MS, SGB, HB)
  rMS $Z=10^{-3}$ $Y=0.246$
  bMS $Z=2\ 10^{-3}$ $Y=0.38$ → $\Delta Y/\Delta Z \sim 130$!!!!
  Relation with CEMP stars ?

- Question: stellar winds or galactic winds ?
  AGB stars or FRMSs ? Very early

Can be tested by chemical differences

-Why does it not affect more the general $\Delta Y/\Delta Z$?

- Relation with Li ? And He-3 ?

- OTHER PROBLEMS

^{3}He:

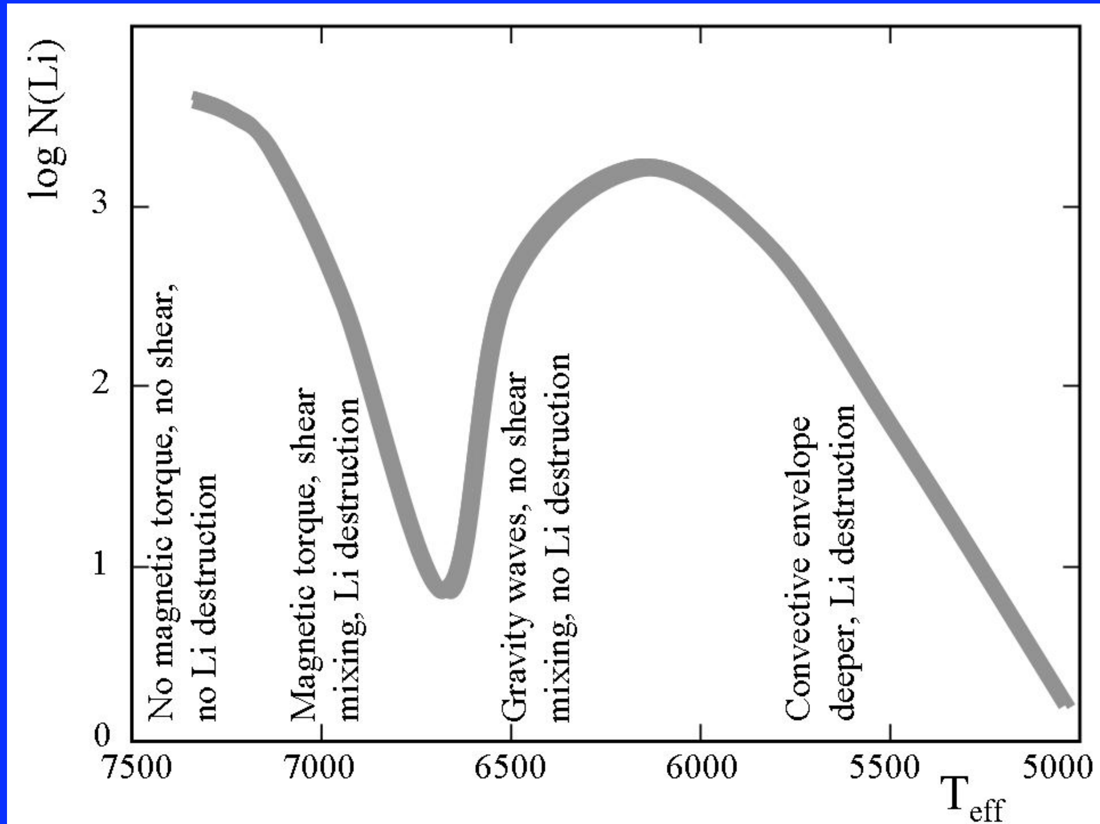
Expectations: $^{3}He/^{4}He$ $\nearrow$ with t or [O/H], $\searrow$ with R(kpc)
(cf. models by Tosi)

Obs: no differences in lunar soils
constant with [O/H], R(kpc), level of WMAP .
but 7 PNe with standard ^{3}He yields

Destruction of He-3 in >90% of 1-2 M_{SUN}
Does some mass range produce ^{3}He and some other destroy it ? Massive stars destroy ^{3}He.
Destruction compensates for creation ?

Thermohaline mixing $^{3}He + ^{3}He \rightarrow ^{4}He + 2p$
Slight μ inversion may be a solution.
The only solution ?

^{7}Li:



Observations:

Too low by a factor of 3 with respect to **WMAP**

A(Li)= f(M, Z, age, rotation, pre-MS, disk….)

Facts and questions:

- ~flat with respect to [Fe/H] and then up to T Tauri
  Main contributors to Li ? Li destroyed in massive stars.

- Evolutionary effects: A(Li) goes slightly up and down
  observed in GC → age dependence
- Teff scales and consequences for Li

Li in RGB, AGB, super-AGB: mass loss

- Evidences of extra-mixing near RGB bump (add. Depletion
- 1% of GK giants are Li-ric
- Large fraction of C-stars with high L
- Li rich AGB relation to CEMP (Li-rich) end of Spite plateau

Mechanisms:

- Hot-bottom burning - Cameron-Fowler process
  Thermohaline mixing
  Parametrized turbulence

- **Pre-galactic Li depletion ? No, similarity halo - ω Cen**

- **Atomic diffusion, gravitational settling**
  ω Cen: age scatter ~5 Gyr → no difference
  → no diffusion

- **Li more depleted in planets hosts (solar type) ?**
  No pollution, but exceptions (Li-6)
  Infall of planets→ mixing. Role of pre-MS evolution: relation to initial rotation, disk lifetimes.

-**Differences according clusters. Related to richness, binary frequencies, average rot. velocities ?**
The 2 components of a binary have different A(Li) (talk by M. Spite)