Oxygen in globular clusters
Theoretical perspectives

T. Decressin

Geneva Observatory
University of Geneva

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Tenerife

Collaborators

Geneva

- C. Charbonnel
- G. Meynet
- S. Ekstrom

Montpellier

- A. Palacios

Bonn

- H. Baumgardt
- P. Kroupa

Paris

- N. Prantzos

Bruxelles

- L. Siess

Chemical properties of GCs

Heavy elements

Low scatter and same trends as field stars

$\Longrightarrow$ Heavy metals come from pre-enrichment of the galactic halo (i.e., are not produced in situ) Harris & Pudritz (1994)

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Light elements: Li to Al

- C-N, O-Na, Mg-Al and Li-Na anticorrelations
- C+N+O nearly constant
- in TO and giants stars

(see eg. Carretta et al. 2010)

He content

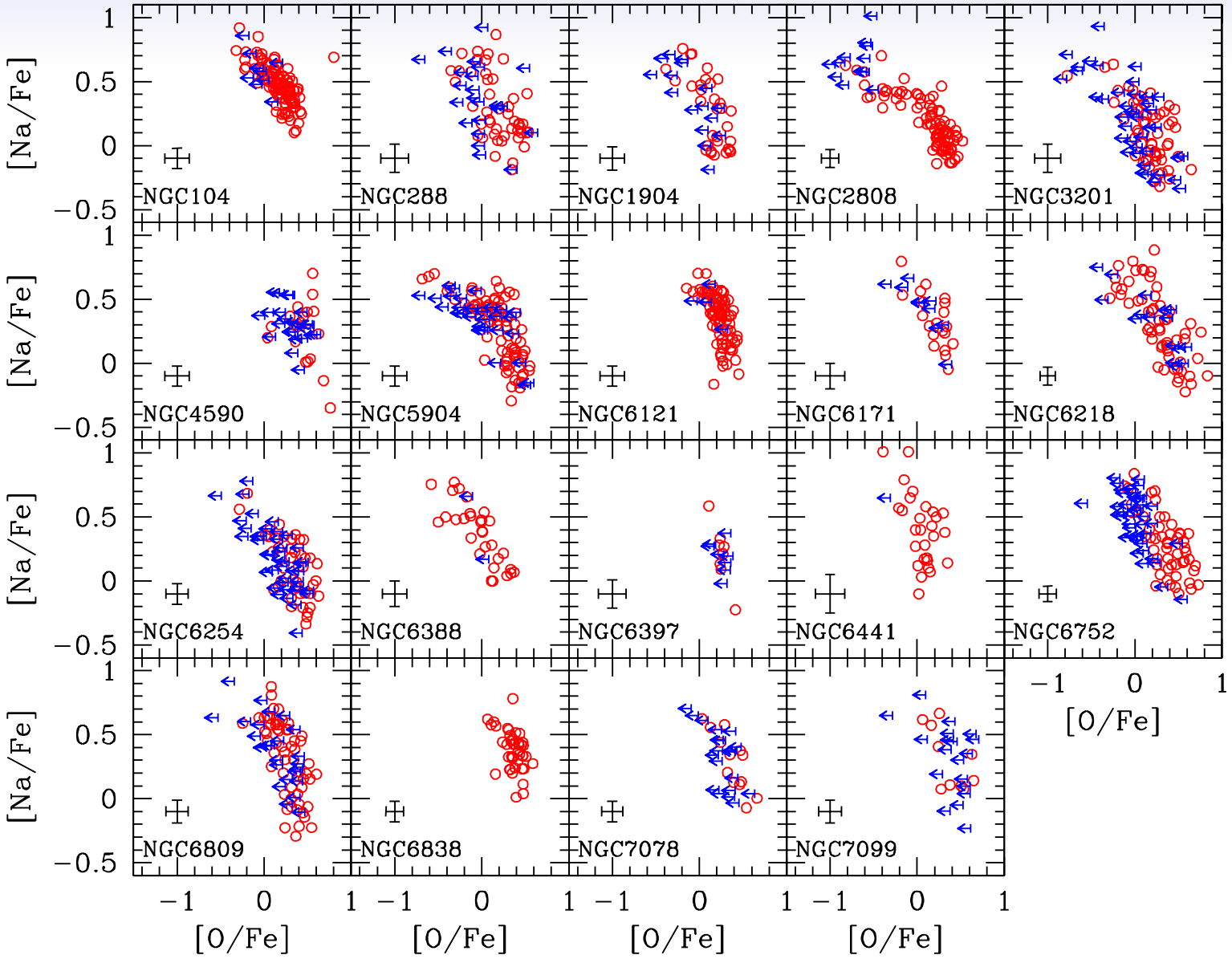
- Multiple main sequences (NGC 2808, ω Cen...)
- Blue HB

$\Longrightarrow$ need He-increase

(see eg. Piotto et al. 2009)

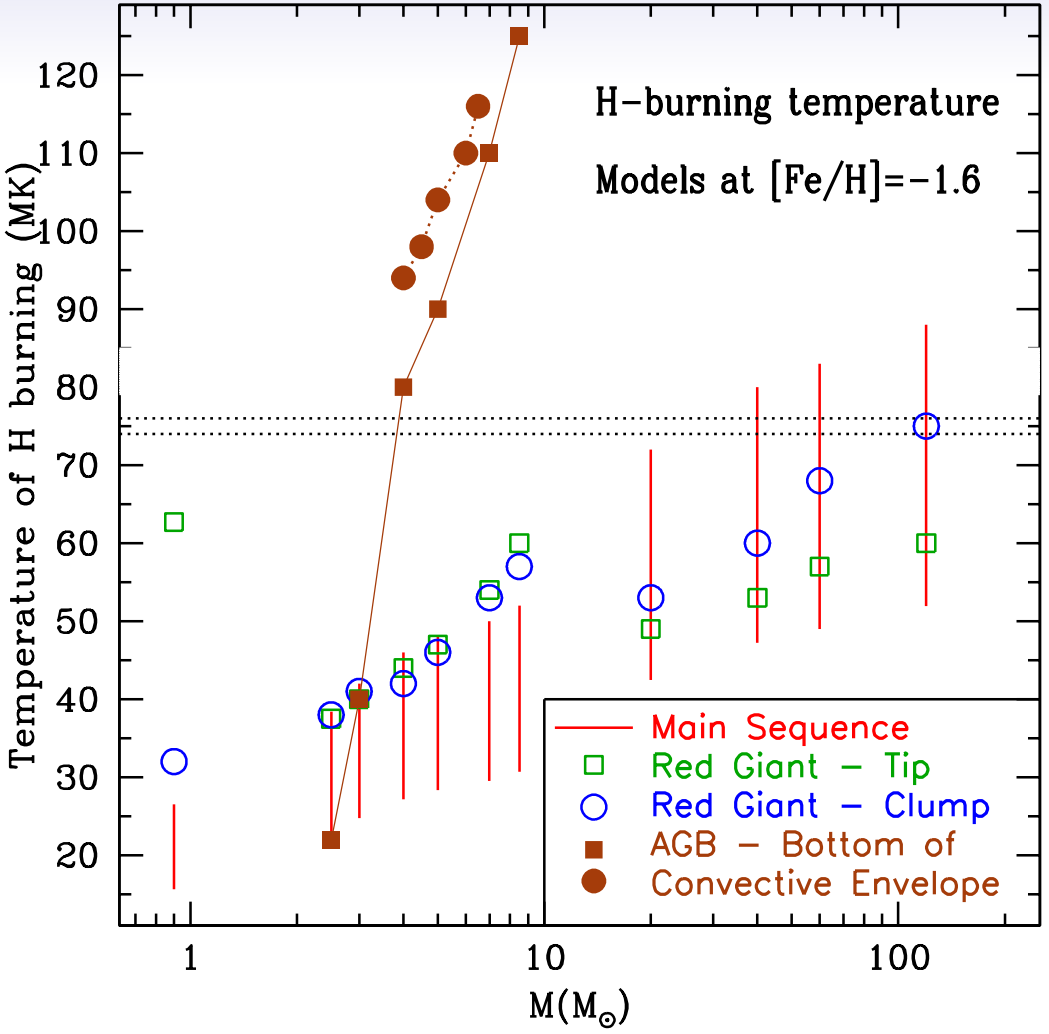
$\Longrightarrow$ Complex history for GCs evolution

O-Na anticorrelation



Carretta et al. 2009

Stellar sources for abundance anomalies

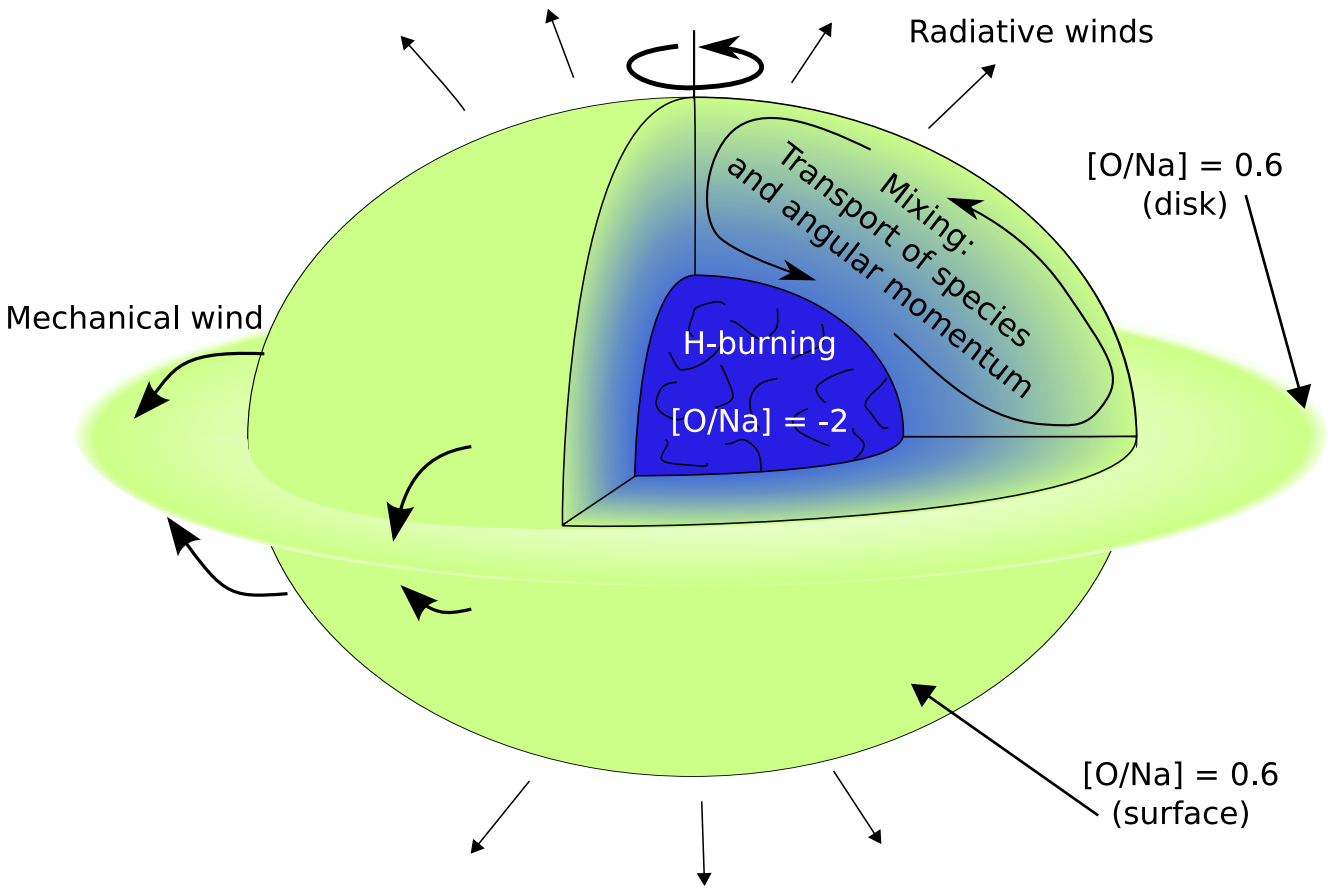


Prantzos, Charbonnel & Iliadis (2007)

$\Longrightarrow$ require pollution by $\left\{ \begin{array}{c} \text{massive AGB stars} \\ \text{and/or} \\ \text{massive main sequence stars} \end{array} \right.$

Overview: fast rotating massive stars

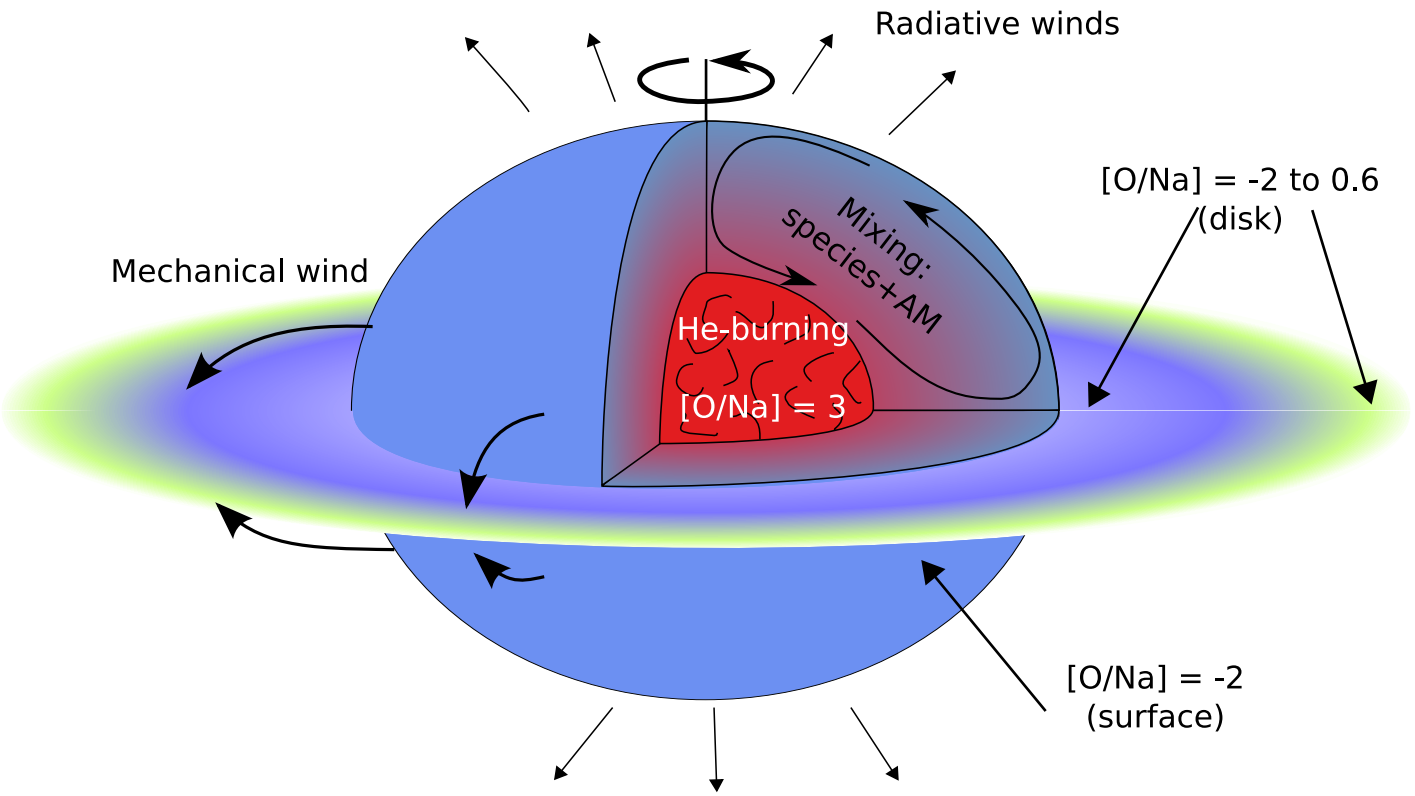
Early main-sequence



Decressin, Meynet, Charbonnel, Prantzos & Ekstrom 2007

Overview: fast rotating massive stars

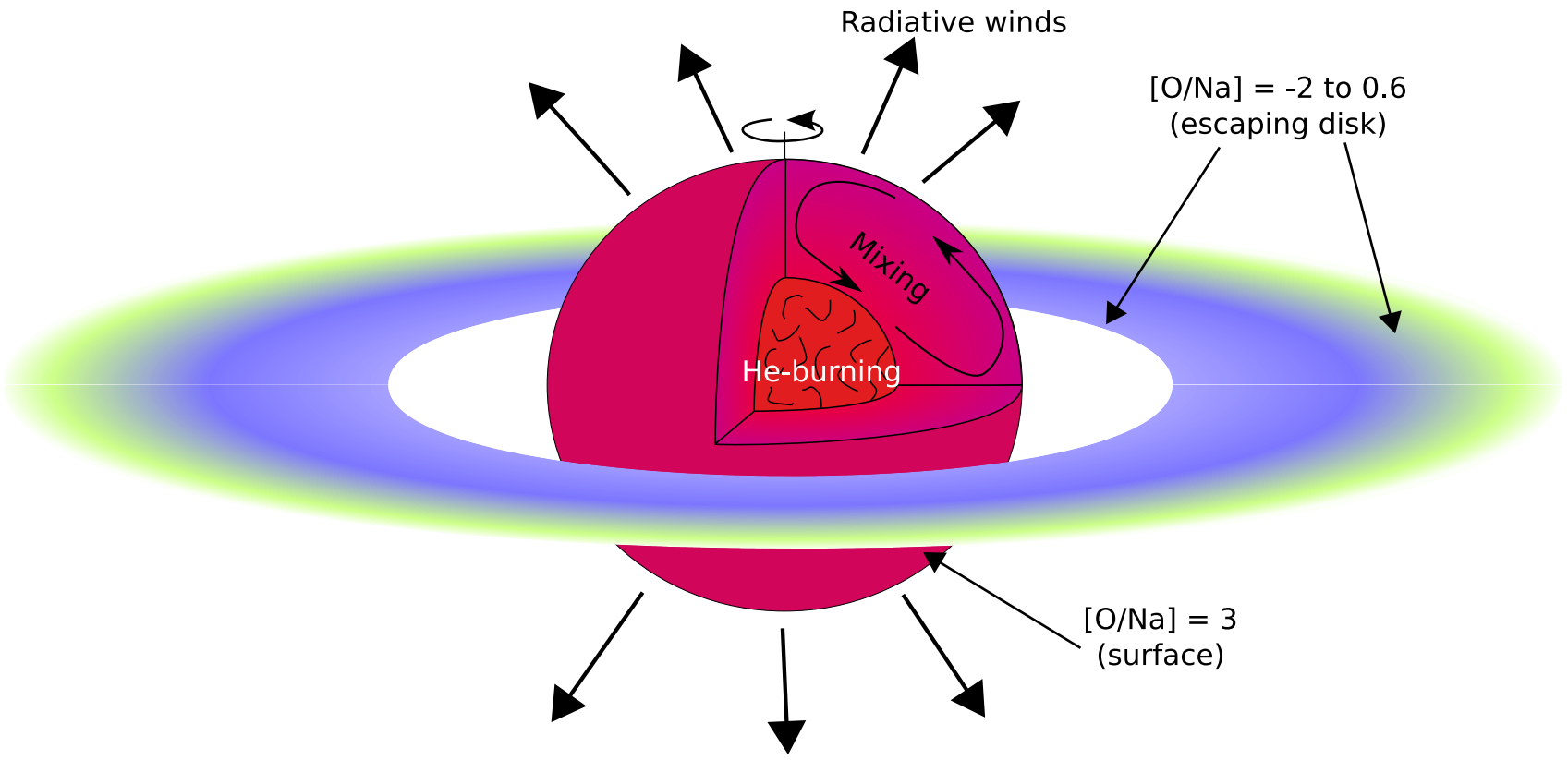
Main-sequence to early He-burning



Decressin, Meynet, Charbonnel, Prantzos & Ekstrom 2007

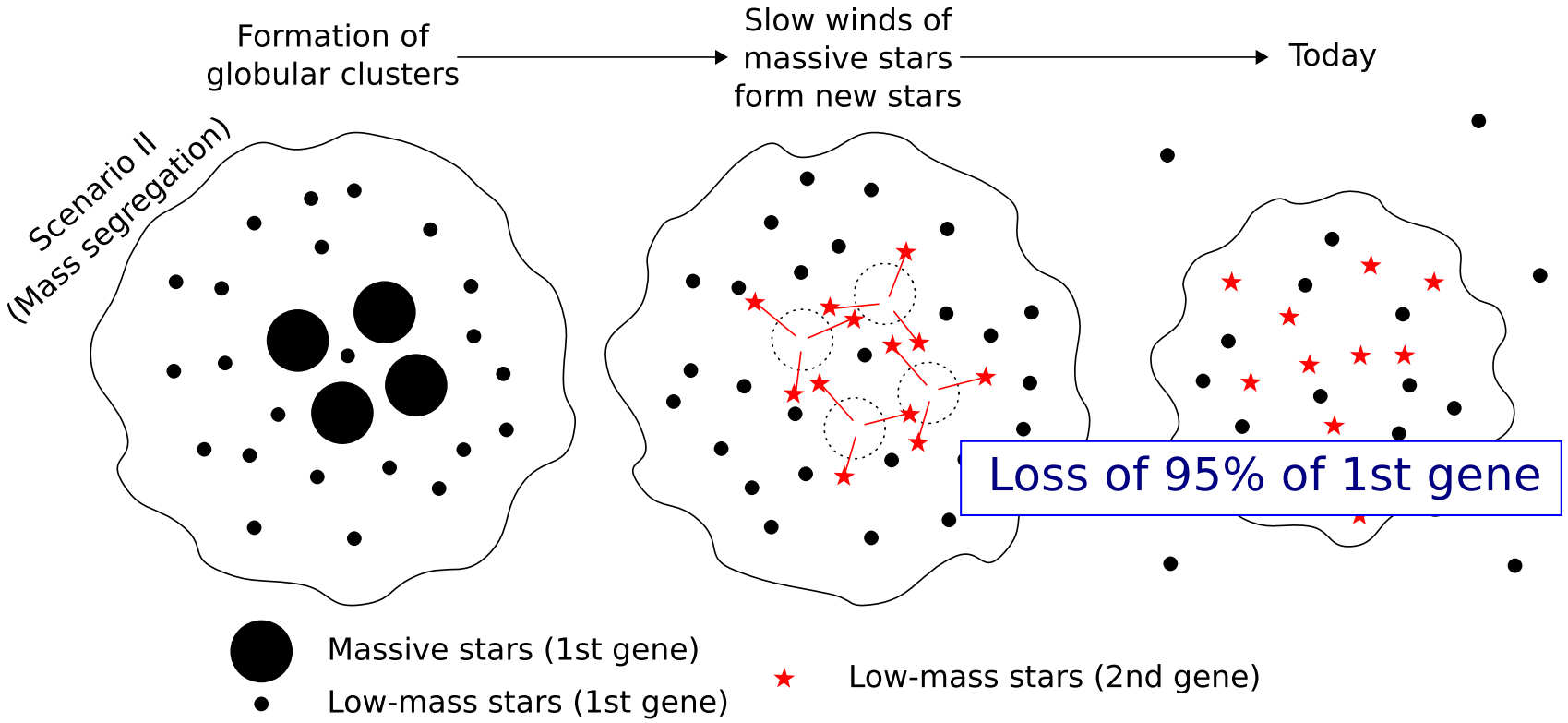
Overview: fast rotating massive stars

End He-burning



Decressin, Meynet, Charbonnel, Prantzos & Ekstrom 2007

Evolution of globular clusters



Decressin, Charbonnel & Meynet (2007)

Effect of gas expulsion

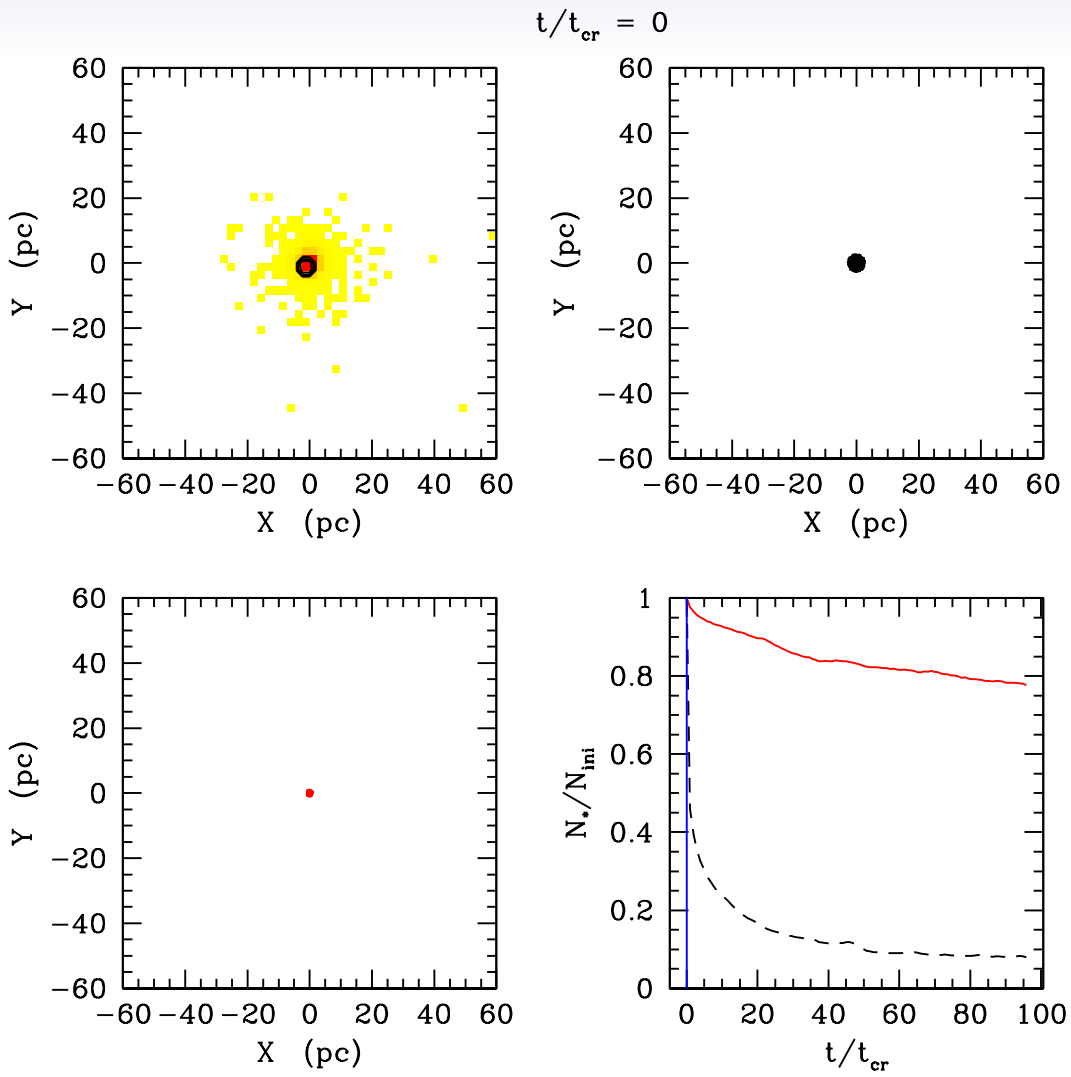
N-body models

Baumgardt & Kroupa (2007)

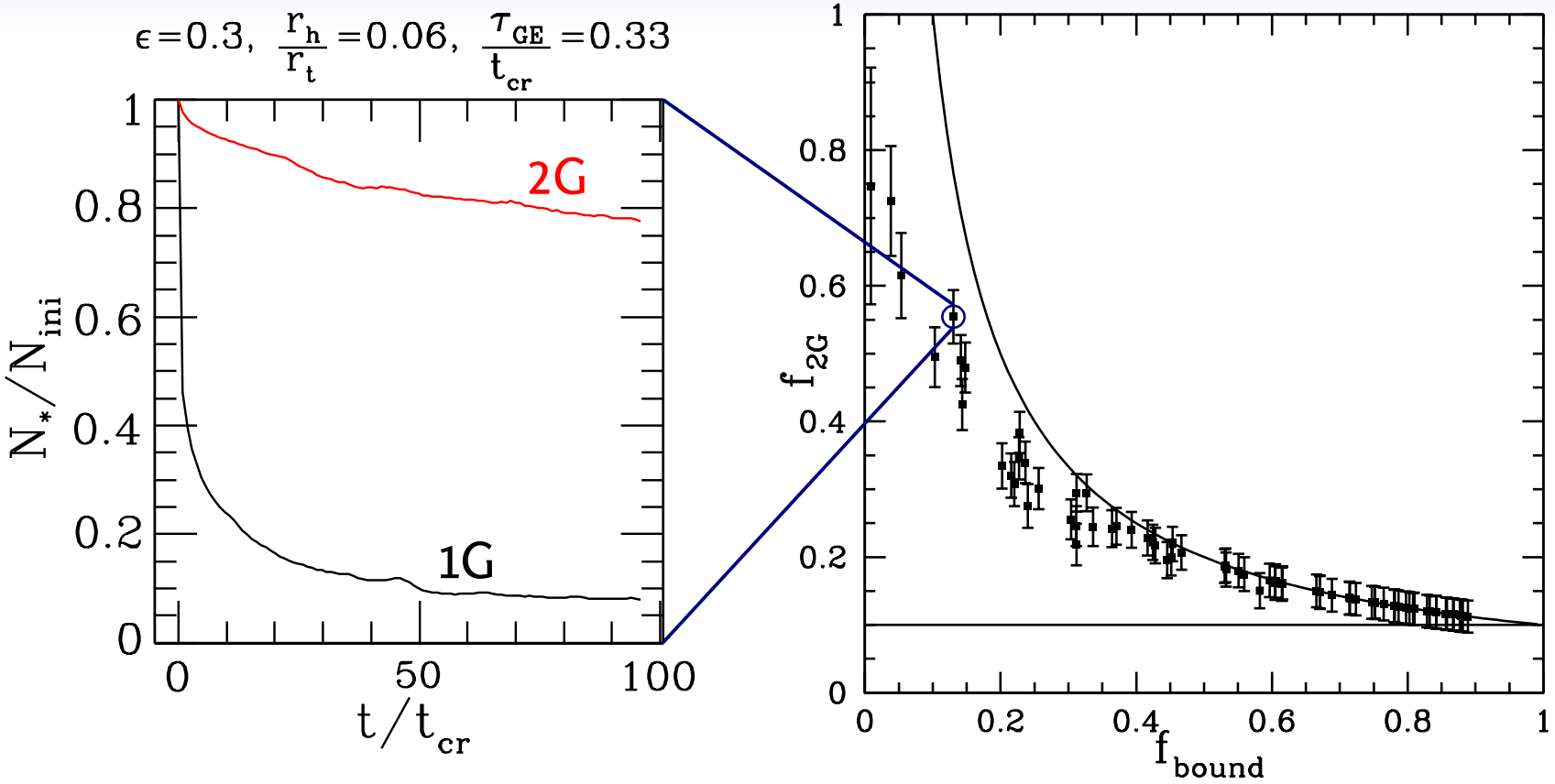
- 20 000 stars
- gas = additional potential + time dependent

Physical inputs

- SFE (ϵ) amount of gas
- r_h/r_t concentrated cluster
- τ_{gas}/t_{cr} timescale of GE



Gas expulsion



Decressin, Baumgardt, Kroupa & Charbonnel (2010)

$\Longrightarrow$ Efficient way to expel 1st gene. stars

$\Longrightarrow$ GCs were 20-30 times more massive at birth

Conclusions

O abundances in GCs

- Reveal the complex history of those objects
- $\rightarrow$ First generation similar to fields stars
- $\rightarrow$ Need filter to kept O-poor matter inside the potentiel well
- $\rightarrow$ Second generation recycles slow wind of massive stars

Dynamical consequences

- Strong ejection of stars due to gas expulsion
- Initial mass of GC much higher